

## ARCADIS Avantic

**SP**

### Replacements of Parts

System

Replacement of Parts

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## Required documents

- ARCADIS Avantic wiring diagram
- For the laser targeting device as applicable: Adjustment instructions/laser targeting device SPR2-330.815.02...

## Required tools, measurement devices, and accessories

### NOTE

All tools, measurement devices and aids with the exception of those marked “\*”, are listed along with their specifications in the STC (Service Tools Catalog).

- Standard tool kit\*
- Digital multimeter, e.g. Fluke 8060 A Part no. 97 02 101 Y4290
- Oscilloscope > 50 MHz, e.g. Fluke CombiScope PM 3390 A Part no. 99 00 861 Y3155
- Dose measurement device  
e. g. DALI PTW\* no longer in ARTD  
or NOMEX PTW\* no longer in ARTD  
or DIADOS PTW Part no. 97 17 612 Y0388
- Ground wire test meter  
e.g. Unimed 1000 tester Part no. 51 38 727 Y0766
- 1 set of resolution tests e.g. part no. 28 71 820 RE999
- 1 set of radiation filters e.g. part no. 97 98 596 G5321
- Centering cross e.g. part no. 96 60 051 RE999
- WPS heat conducting paste e.g. part no. 20 48 650 SRN 6400
- 200 N spring scale e.g. part no. 44 15 113 RH090
- Torque wrench 20 Nm to 100 Nm e.g. part no. 80 86 159 RE999
- Torque wrench 10 - 80 Ncm (necessary for image rotation adjustment) Part no. 080 79 241
- Loctite 221

- Optimol Viscogen KL 300, 50 ml Part no. 72 79 107
- Sealing compound\* Part no. 20 49 716 SRN 6002

### Text emphasis

<b>⚠ DANGER</b>	DANGER indicates when there is an immediate danger that leads to death or serious physical injury.
<b>⚠ WARNING</b>	WARNING indicates a risk of danger that may lead to death or serious physical injury.
<b>⚠ CAUTION</b>	CAUTION used with the safety alert symbol indicates a risk of danger that leads to slight or moderate physical injury and/ or damage to property.
<b>NOTE</b>	NOTICE used without the safety alert symbol indicates a risk of danger that if disregarded leads or may lead to a potential situation which may result in an undesirable result or state other than death, physical injury or property damage.

Fig. 1: Safety notes

<b>NOTE</b>	NOTE contains information provided with special emphasis to facilitate proper use of the equipment or proper execution of a procedure, i.e. hints, tips.
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## Symbols



This symbol means “X-ray”, checks and adjustments that must be performed with radiation ON.



This symbol means “Dangerous electrical voltage”, >25V ~ or > 60V \_ .



This symbol means “Caution”, general possibility of risk.



This symbol indicates components sensitive to electrostatic discharge (ESD).



This symbol means “Torque Value”, note about a threaded connector.

## Safety information

**NOTICE**


When performing service work and tests, please note:

- ⇒ the product-specific safety information in the document,
- ⇒ the safety information in TD00-000.860.01.. in the register of the ARCADIS binder, as well as
- ⇒ the safety information contained in ARTD part 2.

**WARNING**

**Dangerous X-ray radiation during checks and adjustment work steps.**

**Risk of death or serious physical injury.**

- ⇒ For checks and adjustments that must be performed with the radiation switched on, the prescribed radiation safety measures must be observed; if necessary, wear radiation protective clothing (see also ARTD-002.731.02.. and ARTD-002.731.38.. General Guidelines for Technical Service). These checks and adjustments are explicitly labeled on the following pages with the radiation warning symbol:  .

**WARNING**

**Risk of physical injury or death and property damage!**

**Noncompliance can lead to death, physical injury or property damage.**

- ⇒ The product-specific safety information in these instructions,
- ⇒ The general safety information in instructions TD00-000.860.01... and
- ⇒ The general safety information according to ARTD part 2.

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**⚠ WARNING****Electrical voltage!**

Noncompliance can lead to death, physical injury or property damage.

- ⇒ After the system covers are removed, voltage-conducting parts are exposed. To prevent danger, the system must be disconnected from the line voltage before the covers are removed. To do this, disconnect the system power plug or switch its power supply off and secure the power switch against accidental re-activation.
  - ⇒ Any service required in connection with electrical voltage should be performed in accordance with general service information TD00-000.860.01..
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**⚠ WARNING****Electrical voltage!**

Noncompliance can lead to death, physical injury or property damage.

- ⇒ After servicing the primary circuit of the ON/OFF assembly (e.g. replacing the ON/OFF assembly or any of its components), it is necessary to measure and record the equivalent system leakage current / see system manual or log book).
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**⚠ WARNING****Danger of pathogen infection!**

Noncompliance can lead to death or physical injury.

- ⇒ This product is released for use in operating rooms and can be contaminated with infectious blood or other body secretions.
  - ⇒ Avoid all contact with blood or other body secretions!
  - ⇒ Comply strictly with the preventive measures against infectious diseases specified in ARTD-002.731.37.. !
-

**⚠ WARNING****Dangerous electrical voltage!**

Noncompliance can lead to death, physical injury or property damage.

- ⇒ With the exception of measurement and test activities, work may not be performed on components with a voltage of more than 25V AC/60 V DC according to ARTD-002.731.17...
  - ⇒ After completing all service work and attaching all system covers, you must perform a ground wire test according to ARTD-002.731.17... . The ground wire resistance must not exceed 0.2 Ohms.
- 

**⚠ CAUTION****Risk of being burned by hot parts or components!**

Noncompliance can lead to first- or second-degree burns, especially on the hands.

- ⇒ Once the covers have been removed, exposed parts or components (e.g. power components, heat sinks, solenoid brakes) may exhibit temperatures of up to 50°C during operation. To prevent burns, switch off the system power supply before touching any parts or components and let the system cool off for at least 5 minutes before resuming work.
- 

**⚠ CAUTION****ESD protection!**

Noncompliance can lead to property damage.

- ⇒ ESD protection guidelines must be observed during servicing.
-

## Measuring the equivalent system leakage current

### Ground wire resistance test information

Observe the instructions in the “Safety Rules for Installation and Repair” (ARTD-002.731.17 ...).

The ground wire resistance must be measured after every intervention in the system.

However, documentation of the measured values is required only during periodic safety checks.

If parts/components that can significantly influence the ground wire resistance (e.g. replacement of the power cable, replacement of the power-up module, replacement of multi-pole connection cables, which also create the ground wire connection between system parts (e.g. monitor cable or C-arm cable)) are replaced or if ground wire connections have been repaired, the ground wire resistance must be measured. The values are to be documented and assessed in the ground wire resistance protocol.

<b>NOTE</b>
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**For evaluation purposes, the first measured value and the values documented during maintenance or safety checks are to be compared to the measured values. A sudden or unexpected increase in the measured values may indicate a defect in the ground wire connections - even if the limit value of 0.2 ohms is not exceeded. (Ground wire or contacts).**

The measurement must be performed according to DIN VDE 0751, Part 1 (see ARTD Part 2). In this case, the ground wire resistance for all touchable conductive parts must be measured during the normal operating state of the system.

Make sure that control cables or data cables between the components of the system are not mistaken for a ground wire connection.

During the measurement, the power cable and additional connection cables, which also create the ground wire connection between system parts (e.g. monitor cable between the basic unit and monitor trolley,) must be moved section by section to detect cable breaks.

Ground wire resistance may not exceed 0.2 Ohms.

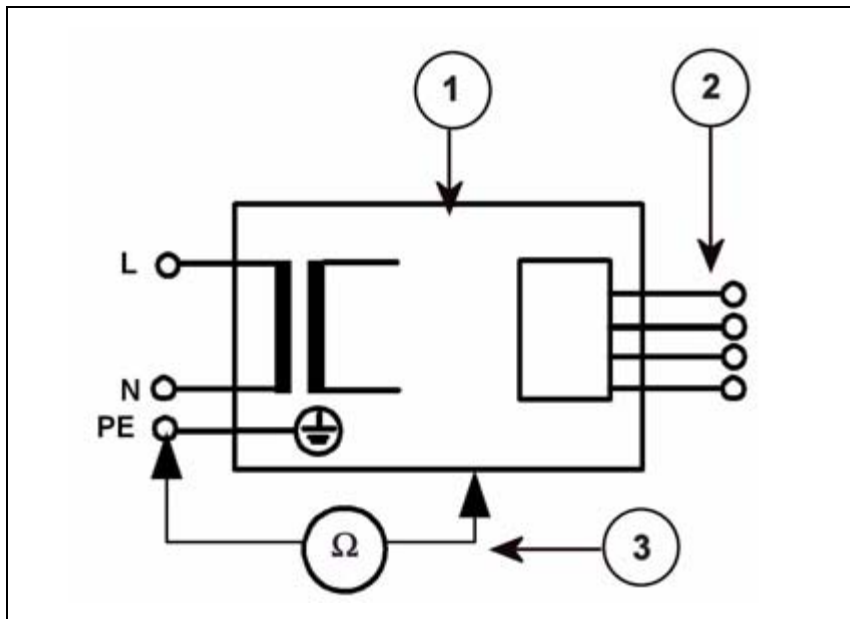


Fig. 2: Measuring circuit for measuring the protective conductor resistance for units that are disconnected from power, in compliance with DIN VDE 0751-1/2001-10, Fig. C2.

- Pos. 1 = System  
 Pos. 2 = Application part type B (if available)  
 Pos. 3 = Measurement setup (integrated into measuring device)

## System leakage current measurement information

### NOTE

If parts in the primary circuit (e.g., power cable, line filter, power transformers, or complete power-on modules) are replaced during service work, the system leakage current measurement must be subsequently performed and recorded as a repeat measurement.

However, the first measured value is to be newly determined and a new protocol is to be created under the following conditions:

- Lack of system leakage current measurement documentation
- Local line voltage or line frequency deviating from the line voltage and line frequency values documented in the protocol (e.g., in the event of a site/operator change)
- Use of a different procedure for measuring the system leakage current other than the one documented in the protocol.

For the purpose of traceability, reference to the new protocol is to be written on the old protocol. The reason for newly determining the first measured value is that it be documented and confirmed with a name and signature.

Observe the instructions in the “Safety Rules for Installation and Repair” (ARTD-002.731.17 ...).


**WARNING**

## Electrical voltage!

Noncompliance can lead to severe injuries and even death.

- ⇒ The system leakage current measurement may be performed on units of protection class I only after the ground wire test has been passed.

### First measured value

The first measured value was already determined and documented in the system leakage current protocol. The measuring procedure was also recorded.

The measurement was performed with the recorded line voltage, line frequency and with the recorded measuring equipment.

### Measurement

Perform the measurement according to DIN VDE 0751, Part 1 (see ARTD-002.731.17....), and record the determined value.

The measuring procedure indicated in the protocol is to be used.

If the first measured value has to be newly determined (see previous information), a measuring procedure can be selected (direct measurement or differential measurement).

Measurement of the system leakage current according to the differential current method (measurement setup according to (Fig. 3 / p. 15)) must be given preference, since this method is not dangerous to the person performing the measurement and other persons.

However, please note the minimum resolution of the system leakage current measuring instrument and any additional manufacturer's data restricting the use of the measuring device.

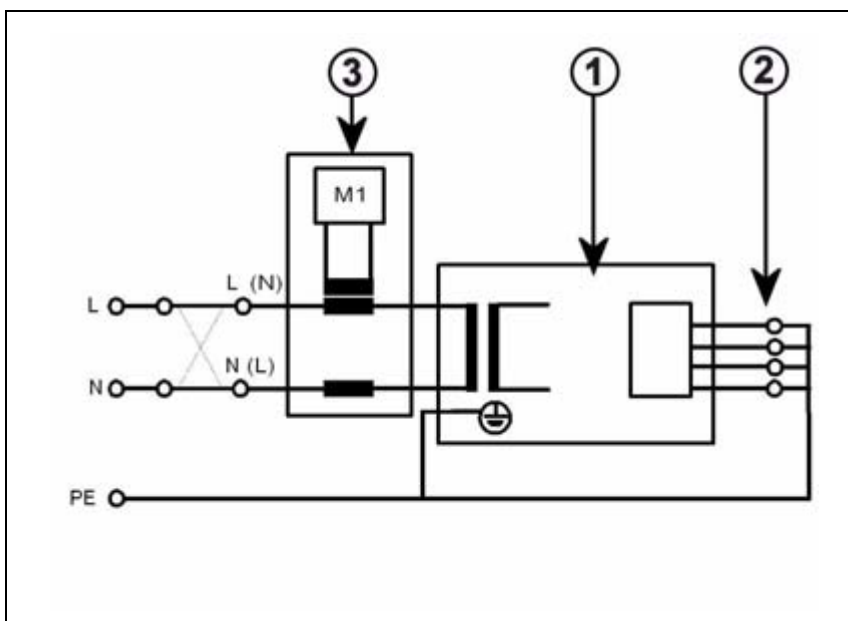


Fig. 3: Measuring circuit for measuring the leakage current according to the differential current

method in compliance with DIN VDE 0751-1/2001-10, Fig. C6 for protection class I.

- Pos. 1 = System  
 Pos. 2 = Application part type B (if available)  
 Pos. 3 = Measurement setup (integrated into measuring device)

If the direct measurement of the system leakage current is used (measurement setup according to (Fig. 4 / p. 16)), the system must be insulated during the measurement and must not be touched.

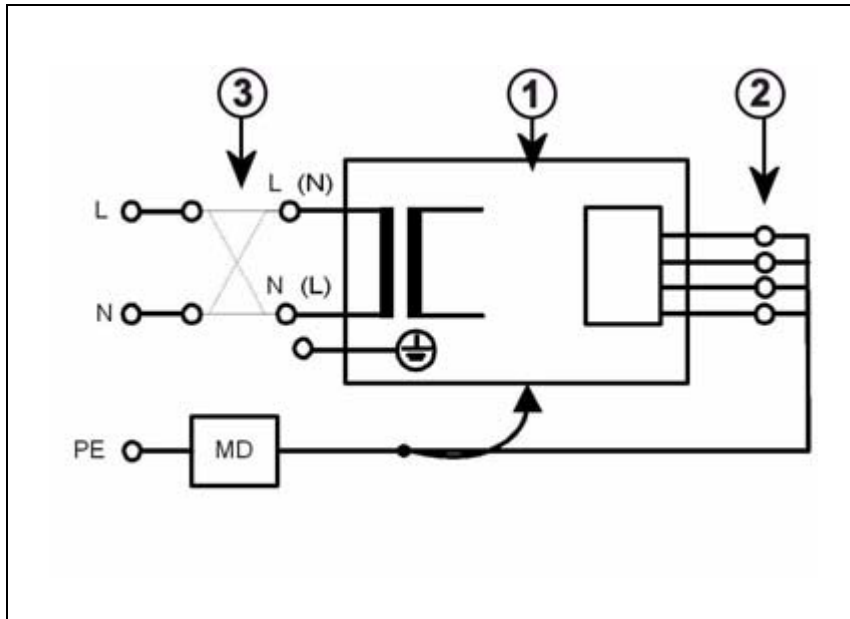


Fig. 4: Measuring circuit for direct measurement of the leakage current in compliance with DIN VDE 0751-1/2001-10, Fig. C5 for protection class I.

- Pos. 1 = System  
 Pos. 2 = Application part type B (if available)  
 Pos. 3 = Measurement setup (integrated into measuring device)

### **WARNING**

#### **Electrical voltage!**

**Noncompliance can lead to severe injuries and even death.**

- ⇒ **No housing parts of the system may be touched during direct measurement of the system leakage current (measurement setup according to (Fig. 4 / p. 16))**
- ⇒ **Third-person access to the system must be prevented.**

The system must be switched on during the measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.

The highest value is to be entered in the system leakage current protocol.



This value must not exceed the permissible system leakage current values according to DIN VDE 0751-1/2001-10, Table F.1, line "system leakage current for units according to remarks 1 and 3" of 2.5 mA.

Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. This is also to be documented.

Document the measuring procedure (differential measurement or direct measurement) and the measuring device used (designation and serial number).

In the case of repeat measurements, the measured value is also to be evaluated.

<b>NOTE</b>
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**For evaluation purposes, the first measured value and the values documented during maintenance or safety checks are to be compared to the measured values. A sudden or unexpected increase in the measured values may indicate that a fault has occurred in the primary power supply circuit (insulation damage, damage caused by humidity, defective interference suppressor, etc.) - even if the limit value of 2.5 mA is not exceeded.**

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The evaluation is not necessary in the case of a new determination.

The protocol sheet is to be filed in the system folder or log book.

## Covers

**WARNING****Electrical voltage!****If ignored, death or serious physical injury can occur.**

⇒ **Disconnect the line voltage plug prior to removing the covers.**

### Removing the cover of the horizontal carriage

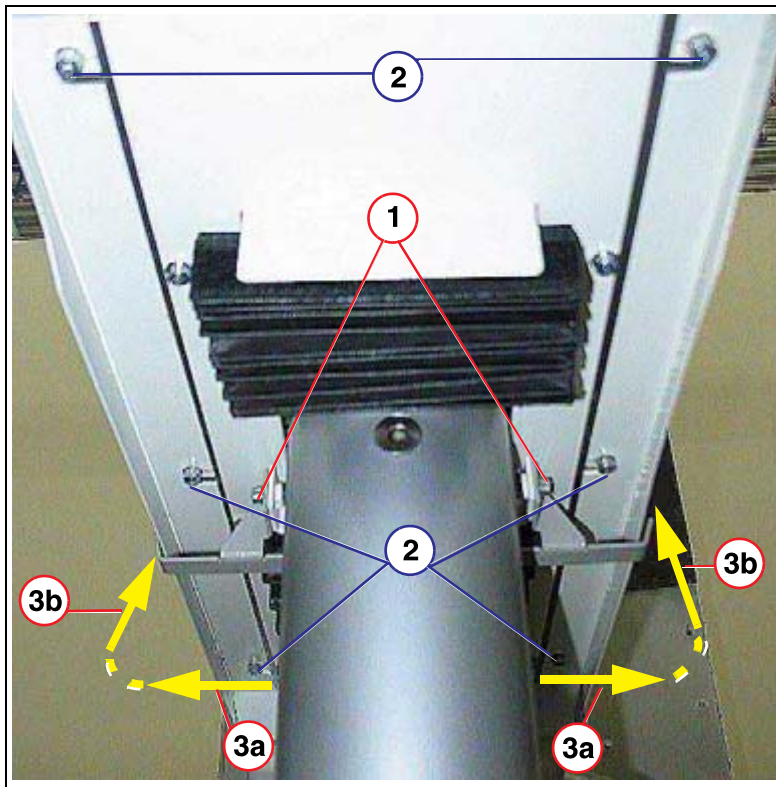


Fig. 5: cover\_1

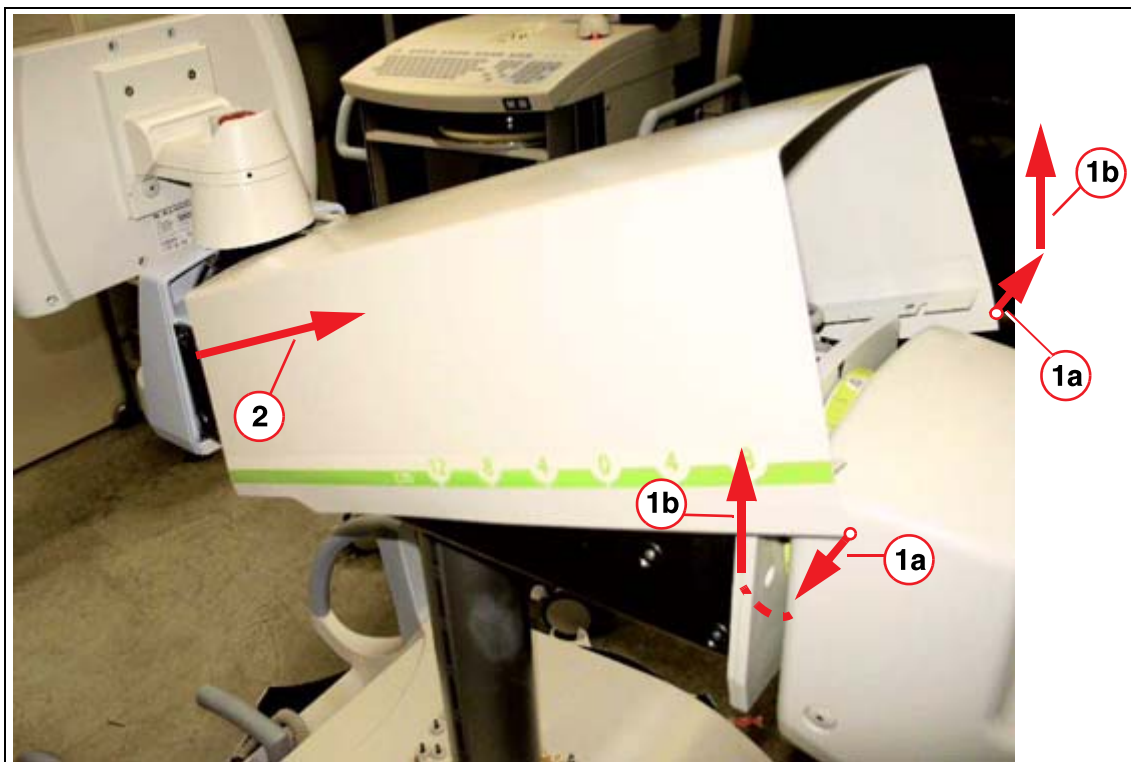


Fig. 6: Cover\_2

**CAUTION**

**Danger of injury when dismantling/assembling mechanical parts!**  
**Noncompliance can lead to minor to moderately severe injury, especially to the hands!**

- ⇒ The cover over the horizontal carriage is U-shaped and must be pulled on the side to the outside when it is removed. This places the cover under mechanical stress.
- ⇒ We recommend wearing light work gloves to avoid injuries.

1. Unscrew the 2 screws (1/Fig. 5 / p. 18).
2. Unscrew the 6 screws (2/Fig. 5 / p. 18).
3. Expand the cover at the end (3a/Fig. 5 / p. 18) (1a/Fig. 6 / p. 19) and pull the cover upward (3b/Fig. 5 / p. 18) (1b/Fig. 6 / p. 19).
4. Pull out the cover as shown in (2/Fig. 6 / p. 19).
5. Reattach the cover in reverse order.

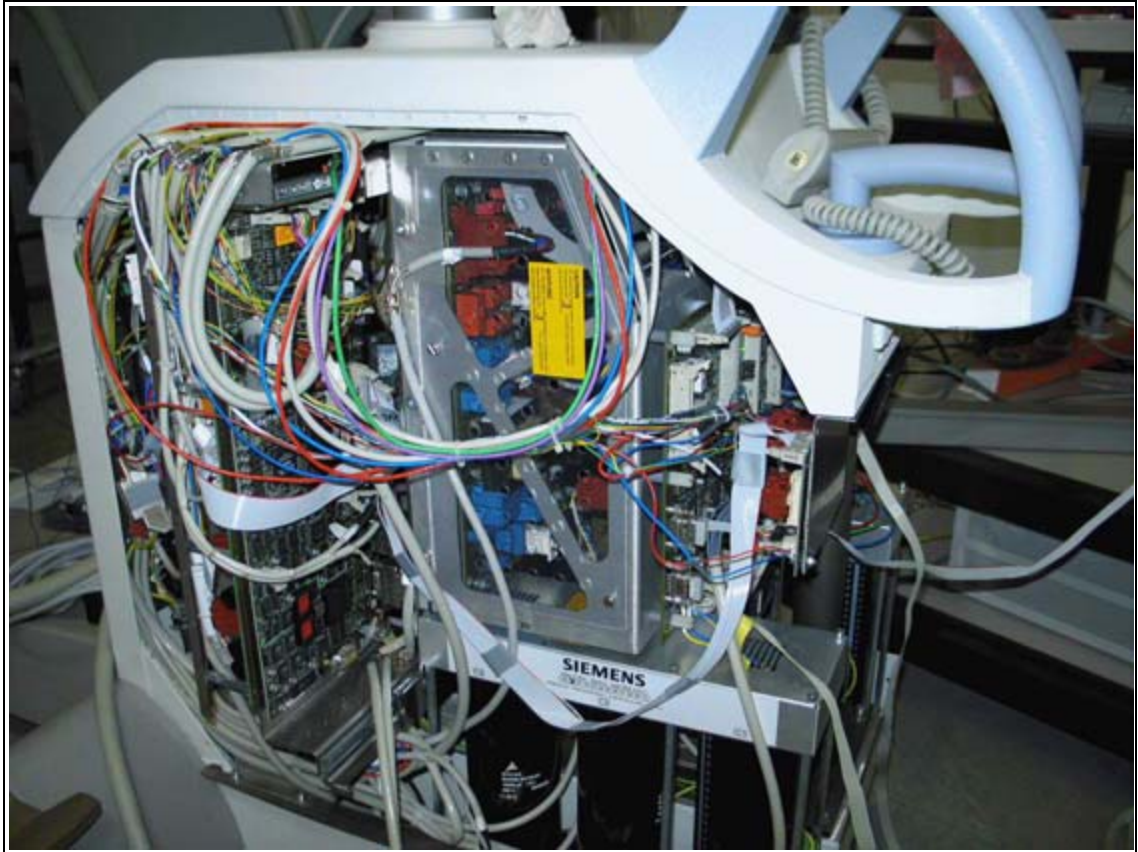
### Removing the cover of the basic unit

1. Apply the foot brake.
2. Remove the foot switch.

3. Remove the screws from the cover.
4. Pull the cover away to the back.
5. Unscrew the protective conductor from the cover.
6. Pull the cover completely off and remove it.
7. Reinstall the cover in reverse order.

### Service position slide-in module

Service position of the board slide-in module in the unit



*Fig. 7: Service\_position*

1. The board slide-in module can be withdrawn after loosening the two screws ([Fig. 7 / p. 21](#)).

**Power supply M13, +13 V\_**

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**Electrical voltage!****If ignored, death or serious physical injury can occur.****⇒ Switch the system power supply off.**

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1. Remove the Plexiglas cover over the power supply. Remove the 4 Allen screws.
2. Replace the power supply.
3. Check the power supply voltage and adjust if necessary ([Voltages / p. 70](#)).

## Power supply M14, +5 V\_ / +15 V \_ / -15 V\_



**Electrical voltage!**

**If ignored, death or serious physical injury can occur.**

⇒ **Switch the system power supply off.**

1. Replace the power supply.
2. Check the power supply voltages and adjust if necessary ([Voltages / p. 70](#)).

## Control board D1

**WARNING**

**X-ray radiation!**

**If ignored, death or serious physical injury can occur.**

⇒ **Observe the safety instructions!**

## Replacement and additional work

**NOTE**

**Board D1 is delivered as a spare part with the basic configuration stored in GAL J32. If J32 is not replaced by the module on the defective board, any enabled options of the system are no longer available!**

**Remove the IC marked J32 from the old board D1 and plug it into new board D1 in base J32.**



1. Withdraw the slide-in module with D1 and D30 in the working position ([Fig. 7 / p. 21](#)).
2. Loosen all plug connections to board D1
3. Replace board D1. Pay attention to the insulating disks.
4. Plug all connection cables back in. Make sure the shields and ground wires are properly positioned.
5. Plug in or switch the jumpers and switches according to the wiring diagram. In particular, check jumpers X95, X96, and X99.
6. Perform the download of the control board D1.

**NOTE**

**After board D1 is changed, the heat values stored in the NVRAM will not be initialized. Therefore, the temperature indicator lights up and the KV/mA displays flash. The heat unit counter decreases the values automatically for several minutes and the unit is ready for the necessary adjustments. To decrease the waiting time, the heat counter may be reset and the unit is then immediately ready for use.**

## Restoring the parameters

1. Restore the parameters of the system to board D1. Open the local service, select the "Backup/Restore" menu and restore the main system parameters.



## Reset the heat values after changing board D1

1. Open the local service and select <Main System>-<Adjustments>-<Load Counter> and perform a load counter reset.
2. Under the <Adjustments> menu, click <Generator Adjustment> and perform a generator adjustment.
3. Under the <Dose rate Adjustment> menu, check the dose rate and adjust it if necessary.
4. Check the function of the collimator; adjust if necessary.
5. Check the function of the collimator displays on the monitor and adjust if necessary.
6. Check the function of the area dose product measuring device (if present).
7. Check the FL / PFL / DCM / DR functions.

## Interface board D30

**WARNING****Electrical voltage!**

If ignored, death or serious physical injury can occur.

⇒ Switch the system power supply off before replacing the board.



1. Replace interface board D30.
2. Check the +27 V\_ /+24 V\_ /+24 V\_ voltages; adjust if necessary ([Low voltages / p. 70](#)).
3. Check the radiation release / format switch-over / vertical column travel / brake functions.

## Generator, D21 including MCB2



**Electrical voltage!**

**If ignored, death or serious physical injury can occur.**

⇒ **Switch the system power supply off before replacing the board.**



1. Loosen all plug and screw connections to D21.
2. Mount the fan.
3. Replace D21. Pay attention to the insulating disks.
4. Make plug and screw connections. Make sure shields and ground wires are properly located and have good contact.
5. Perform generator download. After the download, switch the system off and on again.
6. Perform generator adjustment.
7. Perform the IQ test.

## Power supply unit D20

**WARNING****Electrical voltage!**

If ignored, death or serious physical injury can occur.

- ⇒ Switch the system power supply off.
- ⇒ Wait until LEDs V147 and LED F3-F8 have gone out. To ensure safety, after discharge of the capacitor batteries, the voltage can be checked at test points  $U_{z-}$  and  $U_{z+}$ . The voltage must be  $< 20\text{ V}_{-}$ .



1. Measure the ZW voltage. The voltage must be  $< 20\text{ V}_{-}$ .
2. Loosen all plug and screw connections that go to the outside from the generator unit, boards D20, D21 and D115, also the 3 internally located connectors on the bottom of D20.
3. Unscrew the side plastic covers.
4. Remove the 4 fastening screws on the back of the unit.
5. Push the unit out to the side and place it on a suitable base. Exercise caution with the cables and ribbon cables, otherwise damage may occur.
6. Remove coil connections X10 and X11 on D20.
7. The front aluminum plate has 9 fastening screws with contact washers, in each case 3 above and 3 on the sides. Loosen only the lower screws located on the sides. Unscrew the 7 upper screws.
8. Hinge up the front aluminum plate and loosen the internal plug connections.
9. Remove board D20 including cooling plate.
10. Install new board D20 including cooling plate.
11. Assembly and installation of the unit is performed in the reverse order.
12. Tighten cable connections X7 to X11 with a torque of 4.8 Nm.
13. Perform visual inspection. Make sure shields and ground wires are properly located and have good contact. Pay particular attention to plug connection X5 and X6 on D115.
14. Perform generator learning.
15. Check FL / PFL / DCM / DR functions.

## Starting unit D115

**WARNING****Electrical voltage!**

If ignored, death or serious physical injury can occur.

- ⇒ Switch the system power supply off.
- ⇒ Wait until LEDs V147 and LED F3-F8 have gone out. To ensure safety, after discharge of the capacitor batteries, the voltage can be checked at test points  $U_{z-}$  and  $U_{z+}$ . The voltage must be  $< 20\text{ V}_-$ .



1. Measure the ZW voltage. The voltage must be  $< 20\text{ V}_-$ .
2. Loosen all plug and screw connections that go to the outside from the generator unit, boards D20, D21 and D115, also the 3 internally located connectors on the bottom of D20.
3. Unscrew the side plastic covers.
4. Remove the 4 fastening screws on the back of the unit.
5. Push the unit out to the side and place it on a suitable base. Exercise caution with the cables and ribbon cables, otherwise damage may occur.
6. The front aluminum plate has 9 fastening screws with contact washers, in each case 3 above and 3 on the sides. Loosen only the lower screws located on the sides. Unscrew the 7 upper screws.
7. Hinge up the front aluminum plate and loosen the internal plug connections.
8. Remove board D115.
9. Apply heat conduction paste under the power module.
10. Install new board D115.
11. Assembly and installation of the unit in the reverse order.
12. Perform visual inspection. Make sure shields and ground wires are properly located and have good contact. Pay particular attention to plug connection X5 and X6 on D115.
13. Check the FL / PFL / DCM / DR functions.

## Generator capacitor buffer modules

**WARNING****Electrical voltage!**

If ignored, death or serious physical injury can occur.

- ⇒ Switch the system power supply off.
- ⇒ Wait until LEDs V147 and LED F3-F8 have gone out. To ensure safety, after discharge of the capacitor batteries, the voltage can be checked at test points  $U_{z-}$  and  $U_{z+}$ . The voltage must be  $< 20\text{ V}_-$ .



1. Measure the ZW voltage. The voltage must be  $< 20\text{ V}_-$ .
2. Loosen all plug and screw connections that go to the outside from the generator unit, boards D20, D21 and D115, also the 3 internally located connectors on the bottom of D20.
3. Unscrew the side plastic covers.
4. Remove the 4 fastening screws on the back of the unit.
5. Push the unit out to the side and place it on a suitable base. Exercise caution with the cables and ribbon cables, otherwise damage may occur.
6. Replace the defective capacitor buffer module.
7. Install the generator unit in the reverse order.
8. Check the FL / PFL / DCM / DR functions.

## Control console

### Removing the control console

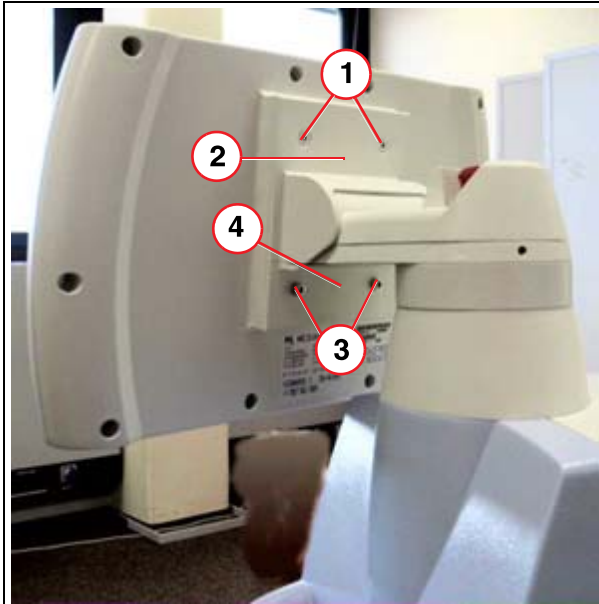


Fig. 8: control\_console

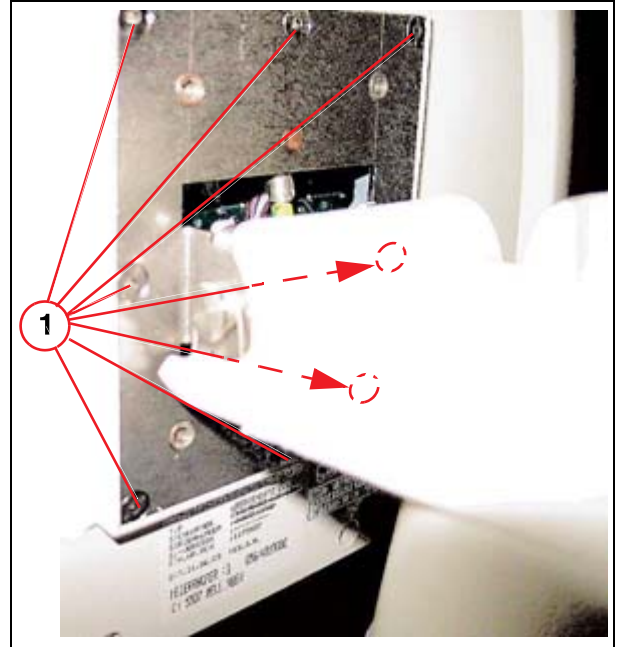


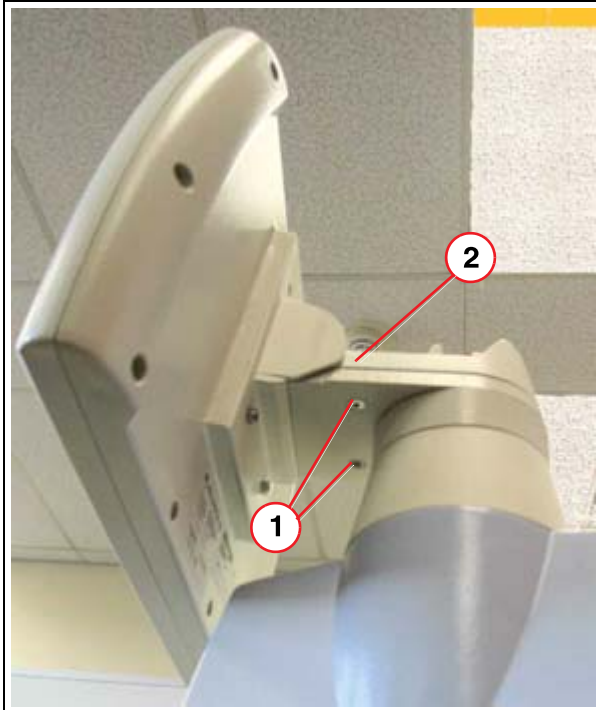
Fig. 9: Control\_console\_2

1. Switch the system off.
2. Unscrew the 2 ISK screws (1/Fig. 8 / p. 31).
3. Remove the cover (2/Fig. 8 / p. 31).
4. Unscrew the 2 ISK screws (3/Fig. 8 / p. 31).
5. Remove the cover (4/Fig. 8 / p. 31).
6. Unscrew the 5 ISK screws (1/Fig. 9 / p. 31), unplug the connectors and remove the control console.



## Emergency stop

### Removing the emergency stop



*Fig. 10: Emergency stop*

1. Switch the system off.
2. Unscrew the 2 ISK screws (1/Fig. 10 / p. 32))
3. Remove the cover (2/Fig. 10 / p. 32).
4. Unplug and remove the emergency stop.



## Single Tank

### Removing the single tank

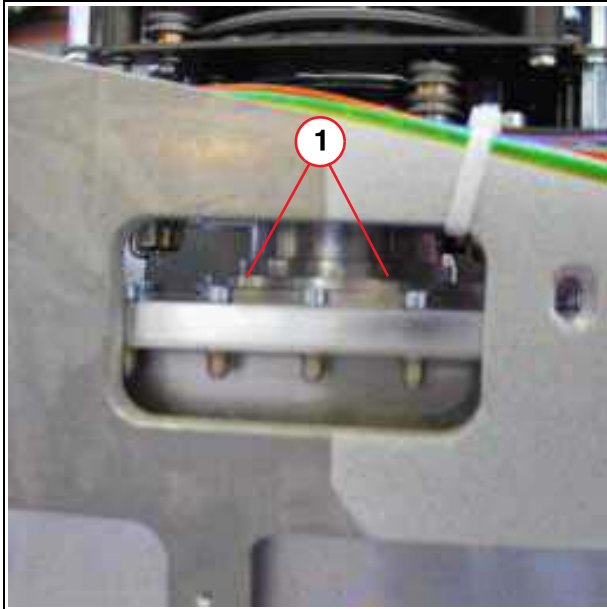


Fig. 11: Collimator\_mount

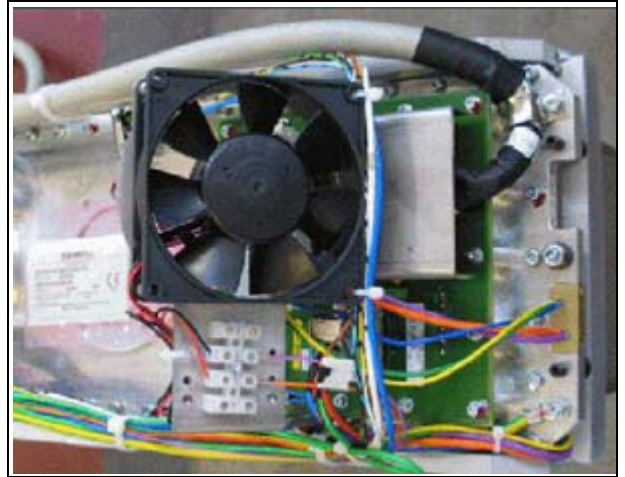


Fig. 12: tank\_connection

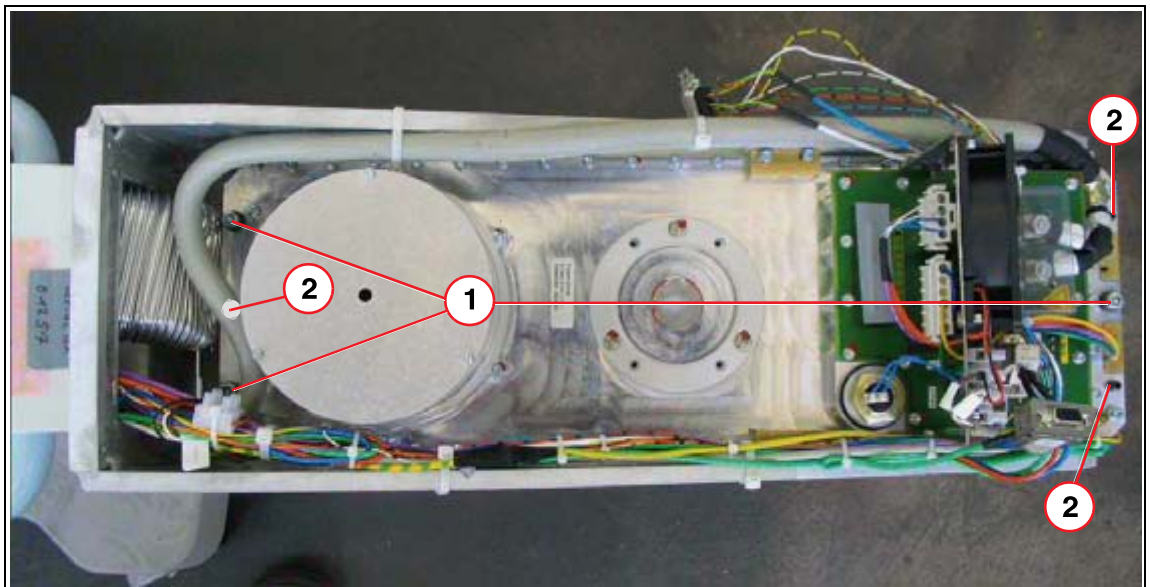


Fig. 13: Adjustment

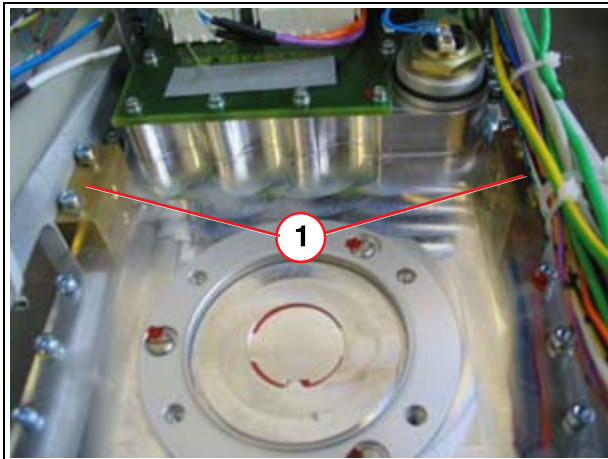


Fig. 14: Bracket

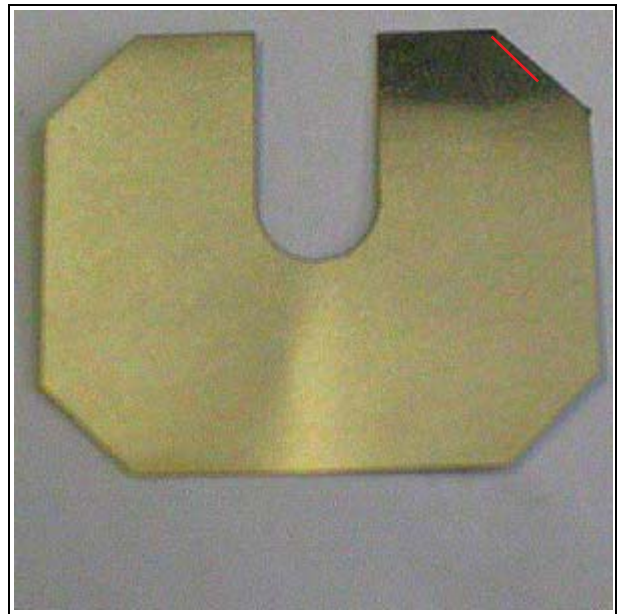


Fig. 15: Shim



Fig. 16: tank\_mount

1. Switch the system off.



2. Remove the single-tank cover.
3. If present, remove the dose measuring chamber.
4. Remove the 4 ISK screws from the collimator and remove the collimator (1/Fig. 11 / p. 33).
5. Loosen all plugs, screw and cable connections from the single tank (Fig. 12 / p. 33).
6. Remove the bracket with fan (Fig. 12 / p. 33).
7. Remove the ISK screw from the connection single tank housing - bracket (1/Fig. 14 / p. 34).
  - ⇒ Single tank housing to bracket is 1 ISK screw at each side.
  - ⇒ Remove the shim(s) (Fig. 15 / p. 34) and remember the position for the installation of the new single tank.
8. Before the replacement, note the height of all grub screws (2/Fig. 13 / p. 33).
9. Loosen the fastening ISK screws of the single tank (1/Fig. 13 / p. 33).
10. Remove and set down the single tank (Fig. 16 / p. 34).
  - ⇒ Guide cable ties through the front and the two rear holes of the fastening screw.
11. Unscrew the grub screws (2/Fig. 13 / p. 33) and screw them into the new single tank.

## Installing the single tank

### CAUTION

#### Risk of injury!

**Risk of injury! Noncompliance can cause minor to medium injury due to crushing of the fingers.**

- ⇒ **Be very careful when inserting the single tank in the C-arm.**

### NOTE

#### The cables must not be crushed!

**On the basic unit, pull out connector D21.X3 from board D21.**

**With an ohmmeter, measure from all leads of the connector X3 (cable side) to protective ground wire. There must be no connection to the protective ground wire!**

1. Switch the system off.
2. Bring the new single tank into the C-arm. Pay attention to cables and your fingers.
3. Attach the single tank with the 3 ISK screws (1/Fig. 13 / p. 33) to the C-arm.
4. Attach the collimator with the 4 ISK screws (1/Fig. 11 / p. 33).
5. If present, attach the dose measuring chamber.
6. Install the bracket with fan (Fig. 12 / p. 33).

7. Connect all cables (Fig. 12 / p. 33).
  - ⇒ Fan + / -
  - ⇒ D25 X1 / X3 / X789 / X7 / X9
  - ⇒ X32
  - ⇒ Z66 X1
  - ⇒ Ground wire
8. Tighten cable connections X7 and X9 (Fig. 12 / p. 33) with a torque of 4.8 Nm.
9. Make sure the cables all run properly and shields are correctly clamped.
10. Set the grub screws (2/Fig. 13 / p. 33) to the distances noted at the start.
11. Screw in the fastening screws (1/Fig. 13 / p. 33), but do not tighten them; leave a few millimeters distance to the housing.
12. Switch on the system.
13. Check the function of the two fans.
  - ⇒ The visible fan must turn.
  - ⇒ The fan installed in the C-arm must run audibly. The visible fan can be stopped mechanically for a short time for this purpose.
14. Perform a generator adjustment (<Local Service>-<Main System>-<Adjustment>-<Generator Adjustment>).
15. Start fluoro and set the collimator opening on the monitor so that all sides are still just visible and stop fluoroscopy.
16. Determine the direction in which the single tank must be aligned.
  - ⇒ Image reversal should be deselected
17. By setting the grub screws (2/Fig. 13 / p. 33) on the single tank, adjust the collimator centrally on the monitor.
18. After each adjustment, release fluoro briefly to display the change on the monitor (LIH).
19. After the collimator has been centered, tighten the fastening screws (1/Fig. 13 / p. 33) uniformly. Take care that the radiation field does not migrate again.
20. Switch on fluoroscopy briefly and check the collimator position.
21. Fix each bracket (1/Fig. 14 / p. 34) with the ISK screw and insert the shim (s) (Fig. 15 / p. 34) into the required position before tightening the ISK screws (use Loctite 221).
  - ⇒ No gap should be between the bracket (1/Fig. 14 / p. 34) and the single tank housing.
22. The blades of the X-Iris must be visible on all sides of the monitor image in fluoroscopy in the full format and zoom format at maximum opening.
23. Check and if necessary adjust the X-Iris and slot diaphragm positions (in the full format and zoom format).
24. Check the function of the area dose product measuring device (if present).
25. A 2nd set of identification labels of the single tank is glued onto the basic unit. Remove the old identification labels of the collimator and glue the supplied labels to the same place. The original labels of the single tank must agree with the glued-on labels.



## Fans

### Visible fan

1. Remove single-tank cover.
2. Disconnect the wires (+ / -) of the fan.
3. Remove the fan ([Fig. 12 / p. 33](#)).
4. Install the (new) fan in reverse order.

⇒ Pay attention to direction of rotation, airflow direction = single tank

### Fan installed in the C-arm

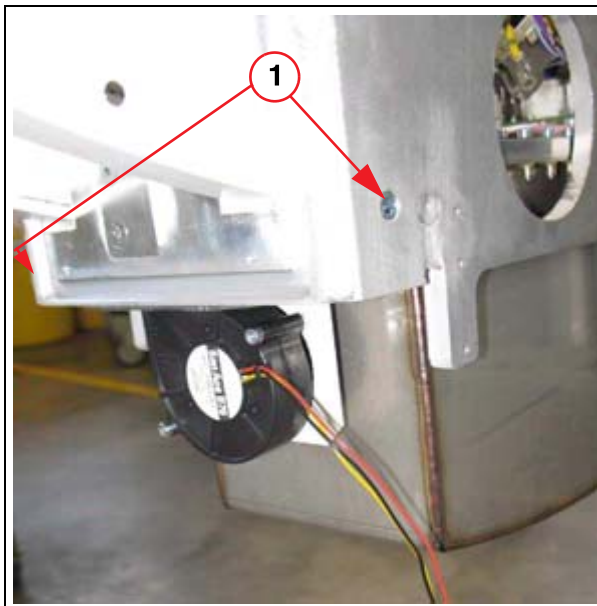


Fig. 17: Fan\_Single\_Tank

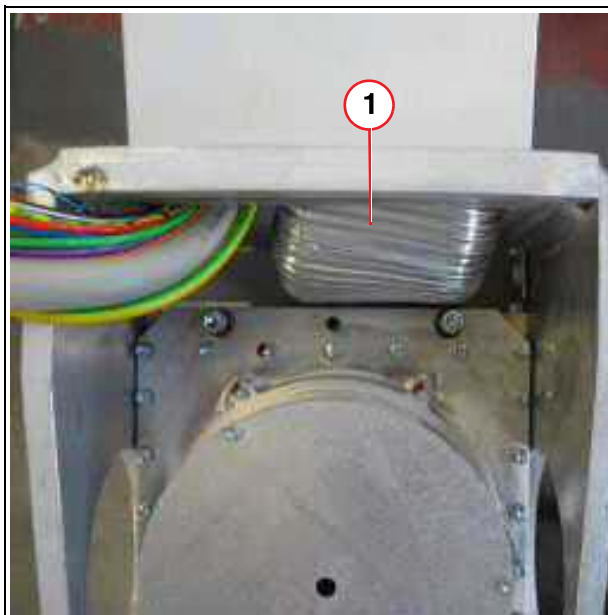


Fig. 18: fan

1. Switch the system off.



2. Remove single-tank cover.
3. Disconnect the wires (+ / -) of the fan.
4. Remove the 2 ISK screws from the fan housing ([1/Fig. 17 / p. 37](#)).
5. Remove the flexible tube ([1/Fig. 18 / p. 37](#)) from the bracket of the fan.
6. Remove the fan.
7. Install the (new) fan in reverse order.
  - ⇒ Pay attention to direction of rotation, airflow direction = single tank

## Collimator

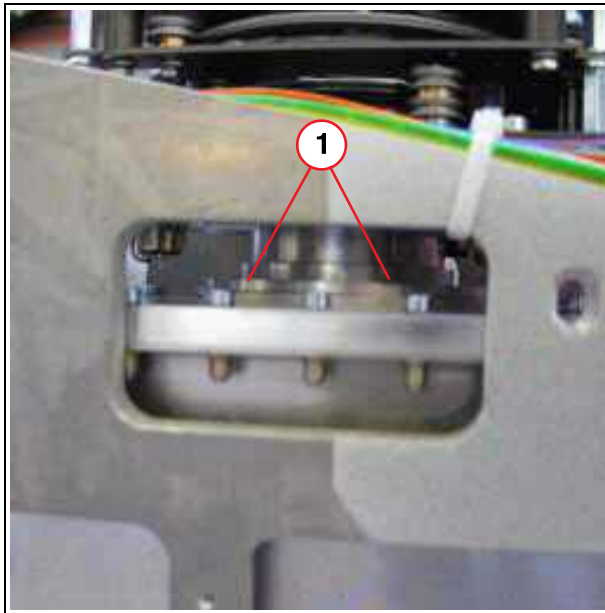


Fig. 19: Collimator\_mount

1. Switch the system off.
2. Remove the 2 ISK screws (1/Fig. 19 / p. 39) from both sides of the collimator cut-outs and remove the collimator.
3. Install the new collimator in reverse order.
4. Check the function and setting of the collimator, readjust if necessary.
  - ➡ The blades of the X-iris on all sides of the monitor image in full format and in all zoom formats.
5. Check the collimator displays on the monitor and readjust if necessary.
6. A 2nd set of identification labels of the collimator is glued onto the basic unit. Remove the old labels of the collimator and glue the supplied labels to the same place. The original labels of the collimator must agree with the glued-on labels.

**Dose Area Product**

1. Switch the system off.
2. Remove the single-tank cover.
3. Replace the Dose Area Product device.
4. Open the local service and select <Main System>-<Adjustment>-<Dose Area Product accuracy check> and check the accuracy of the dose area product measuring device.



## Replacement of the I.I.

A suitable table to deposit the I. I. is required for this work.

### Removing the I.I.



#### Electrical voltage!

If ignored, death or serious physical injury can occur.

- ⇒ See chapter 2, Safety Information.
- ⇒ Switch off the system and wait approx. 3 minutes so that the high voltages on the I.I. mini power supply die away.

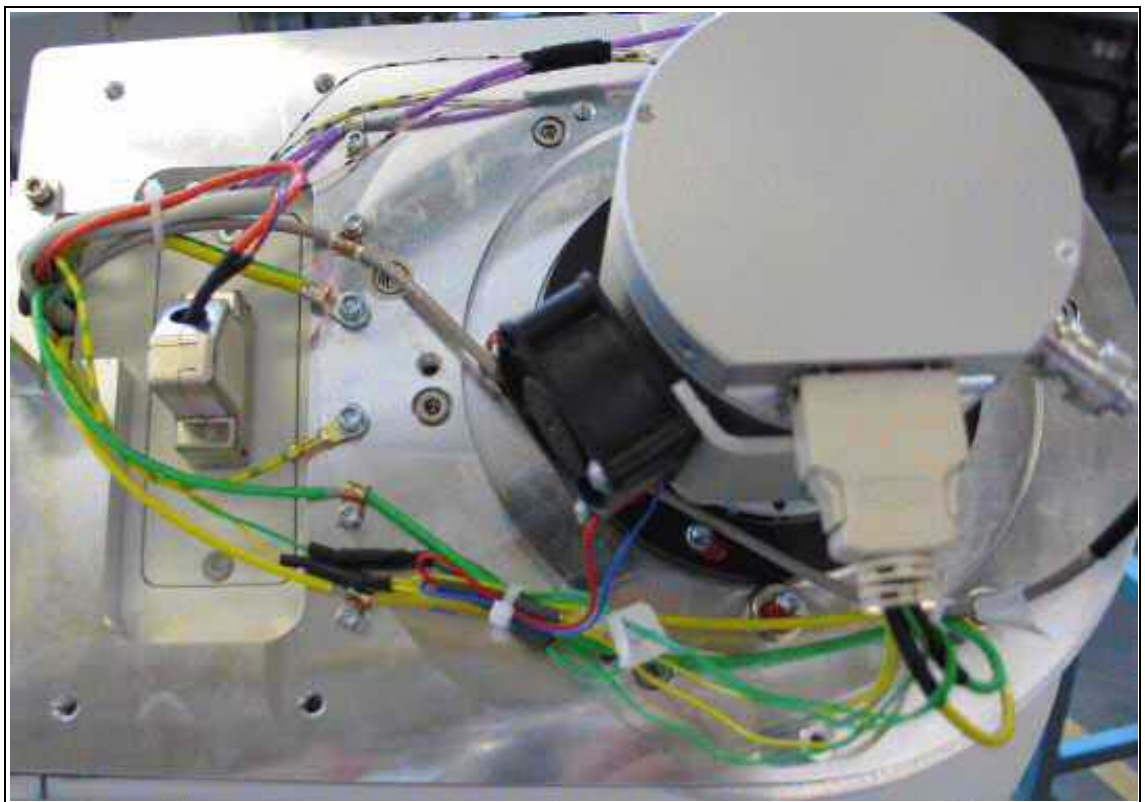


Fig. 20: I.I.\_connection

1. Switch the system off.
2. Remove the cover of the camera from the I. I.
3. Remove the counterweights from the I. I. (already removed in [\(Fig. 20 / p. 41\)](#))

4. Disconnect all cables, cable ties and clips from the I.I. and the camera (Fig. 20 / p. 41).

- ⇒ Fan + / -
- ⇒ M4 X1 / X2 (Gigalink)
- ⇒ Laser I. I. X1
- ⇒ HV 2000 X1
- ⇒ M30 X1
- ⇒ Ground wires

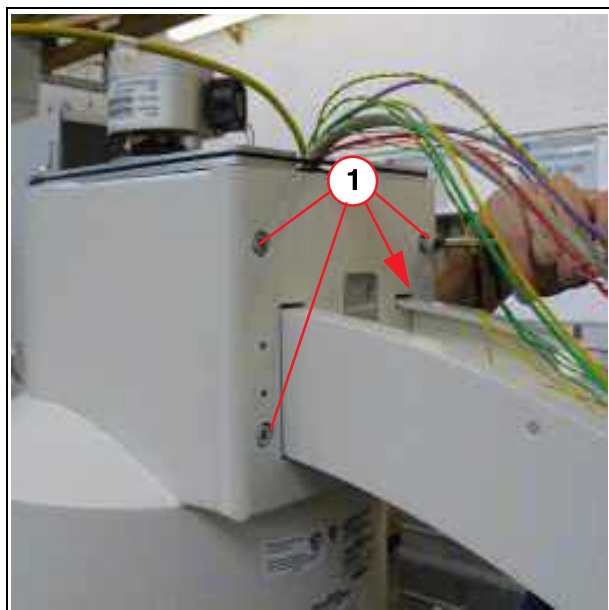


Fig. 21: I. I. cable

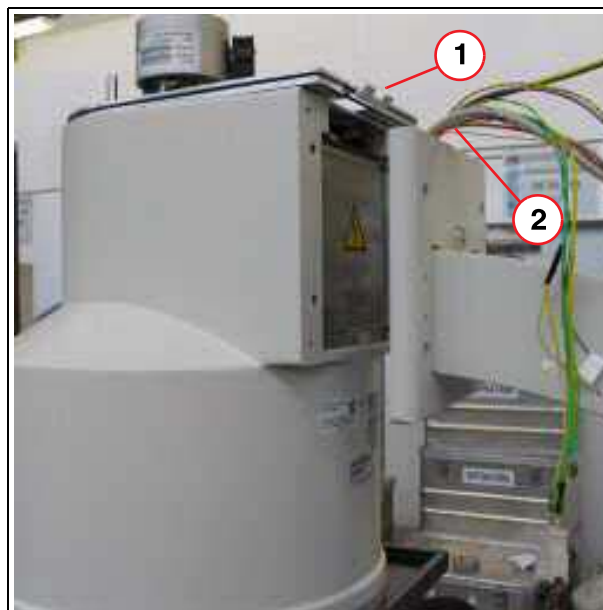


Fig. 22: I.I.\_mount

5. Remove the counterweight from the I. I.
6. Swivel the Image Intensifier in the upper position (single tank below)
7. Remove the grid from the I. I.
8. Place a suitable table underneath of the I. I.
9. Remove the 4 ISK screws and carefully deposit the I. I. on the table.
10. Remove the cable clamp (1/ Fig. 22 / p. 42) and pull out the cables (2/ Fig. 22 / p. 42).
11. Remove the three M4 screws from the camera optics (4/ Fig. 26 / p. 47).

**NOTE**

**Do not loosen the eccentric screws on the edge of the optics! These are used to center the optics with respect to the I.I. output screen. When removing the optics, make sure that no dust or dirt contaminates the I.I. output window or the optics.**

12. Remove the optics and camera and place them on a dust-free surface

## Installing the new I. I.

<b>NOTE</b>
-------------

**When installing the optics, make sure that no dust or dirt contaminates the I.I. output window or the optics.**

1. Reattach the optics and camera to the new I. I.
  - ⇒ The camera optics must lie against the eccentric screws.
2. Take the new I. I. to the C-arm holding device and screw in the 4 ISK screws ([1/Fig. 21 / p. 42](#)) to reattach the I. I. (use Loctite 221).
3. Reinstall and connect all cables, cables ties and clips back to the I. I. and the camera ([Fig. 20 / p. 41](#)).
4. Install the counterweight of the I. I.
5. Install the I. I. grid.
6. Install the cover (camera) from the I.I. housing.

## Checks and adjustments

1. Check the I.I. electrode voltages according to the test protocol for the I.I.
2. Do not make readjustments in cases in which there are only slight deviations from the values on the test protocol (measurement device tolerances).
3. Check the centering, reproduction scale and camera focusing. Refer to the previous description ([Adjusting the camera and I.I. optics / p. 49](#)).
4. Check the X-iris setting and readjust it as necessary.
5. Check the display of the blades on the monitor and readjust it if necessary.
6. Check the dose rate and readjust it if necessary.
7. Check the resolution first and readjust the optical resolution of the I.I. optics if necessary ([Adjusting the camera and I.I. optics / p. 49](#)).
8. Perform the IQ test.
9. Complete the country-specific acceptance (§16 partial acceptance.../DHHS...).

## I.I. mini power supply

**WARNING****Electrical voltage!**

If ignored, death or serious physical injury can occur.

- ⇒ See chapter 2, Safety Information.
- ⇒ Before you remove the high-voltage power supply, the system must be switched off > 3 minutes so that the high voltages on the I.I. mini power supply decay.

## Exchanging or adjusting the I.I. mini power supply

1. Remove the I.I. according to the section "Removing the I.I." .
  - ⇒ Do not remove the camera, optics or I.I. grid.
2. Remove the cover from the high-voltage power supply.
3. Only for exchange: Replace the old high-voltage power supply with the new high-voltage power supply.
4. Continue with "Measuring / Adjusting the I.I. high voltage supply".

## Measuring / Adjusting the I. I. high voltage supply

With the 33 cm image intensifier, the image intensifier must be removed completely to measure the primary voltages. Only then will it be possible to measure the HV 2000 power supply.

For measuring the voltages, remove the RS 232 connector cover on top of the image intensifier to get access to the test points (Fig. 23 / p. 45).

For adjusting the voltages, only unscrew the image intensifier and do not disconnect camera connections and image intensifier wire connections.

- ⇒ With each format, the corresponding potentiometer is active (e. g., P1 for U1), and after the format is changed, the adjusted value will be stored in memory.

**NOTE**

**The reference voltage listed in the Test Certificate for the individual electrodes must be set on the power supply so that the image intensifier is optimally adjusted.**

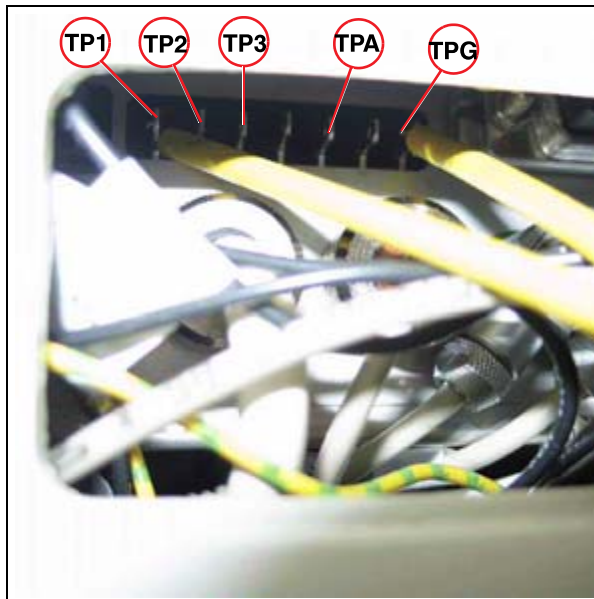


Fig. 23: measuring\_points

Voltage	Test point	Potentiometer	Test Certificate Reference voltage	Voltage divider ratios
U1	TP1	P1	E1	1:100
U2	TP2	P2	E2	1:1000
U3	TP3	P3	E3	1:10000
UA (30 kV)	TPA	PA	A	1:10000
GND (0V)	TPG	n.a.	n.a.	n.a.

## Adjusting the I.I. high voltage supply

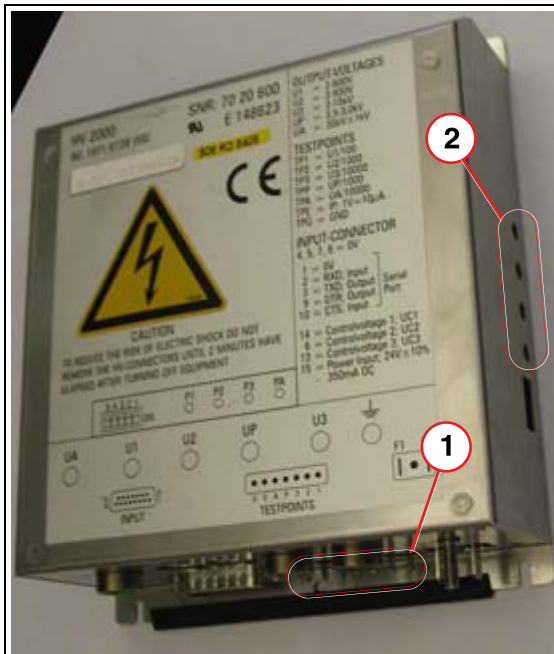


Fig. 24: PS

1. Perform the adjustments only after the HV 2000 power supply has been switched on for 10 minutes.
2. Adjust / measure the voltages at the following potentiometer (2/ Fig. 24 / p. 46) and test points (1/ Fig. 24 / p. 46).
  - ⇨ poti P1 - test point TP1
  - ⇨ poti P2 - test point TP2
  - ⇨ poti P3 - test point TP3
  - ⇨ poti PA - test point TPA
3. Reinstall the I. I. in reverse order.
4. Perform the IQ test.
5. Check the function and setting of the collimator and adjust if necessary.
6. Check the function and setting of the monitor collimator display; adjust if necessary.



## Replacing the camera and the I.I. optics

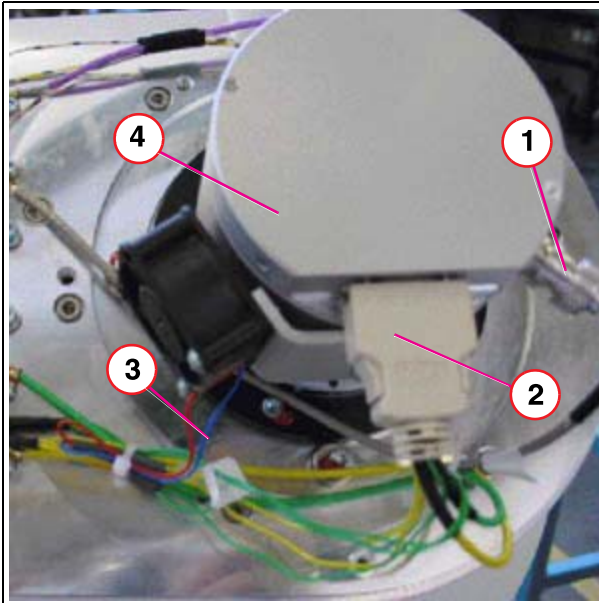


Fig. 25: II \_ Connection

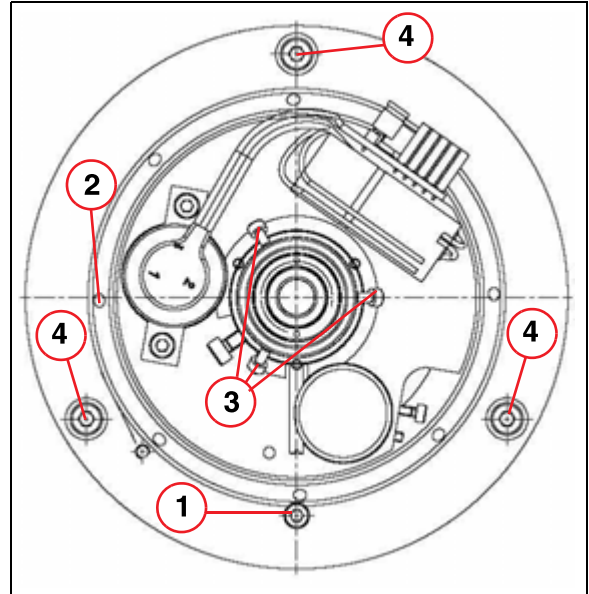


Fig. 26: Replacing the camera and I.I. optics

### Removing/replacing the camera

1. Switch the system off.
2. Remove the upper I.I. cover (already removed in (Fig. 25 / p. 47)).
3. Unplug the connectors (1/Fig. 25 / p. 47), (2/Fig. 25 / p. 47) and disconnect the fan wires (3/Fig. 25 / p. 47).
4. Loosen the clamping screw (1/Fig. 26 / p. 47).
5. Rotate the clamping ring (2/Fig. 26 / p. 47) a half rotation in the counterclockwise direction to loosen the camera. For this purpose, insert an Allen key (2.5 mm) into the hole (2/Fig. 26 / p. 47) and push the clamping ring in the counterclockwise direction.
6. Remove the 3 ISK screws (3/Fig. 26 / p. 47).
7. Turn the entire camera (4/Fig. 25 / p. 47) counterclockwise until it is no longer attached. For subsequent reinstallation, count the number of turns when removing the camera. The connector (2/Fig. 25 / p. 47) should be in the position shown in (Fig. 25 / p. 47).
8. Install the (new) camera in reverse order.
9. Adjust the camera and I.I. optics.
10. Perform the IQ test.
11. Complete the country-specific acceptance (§16 partial acceptance... /DHHS...).

**Removing/replacing the I.I. optics**

**Prerequisites:** Camera must already be removed.

1. Remove the 3 M4 screws ([4/Fig. 26 / p. 47](#)).
2. Remove the I.I. optics.
3. Install the (new) optics and camera in reverse order.
  - ⇒ When screwing in the 3 M4 screws ([4/Fig. 26 / p. 47](#)), make sure that the optic is pushed against the centering bolts.
4. Adjust the camera and I.I. optics.
5. Perform the IQ test.



## Adjusting the camera and I.I. optics

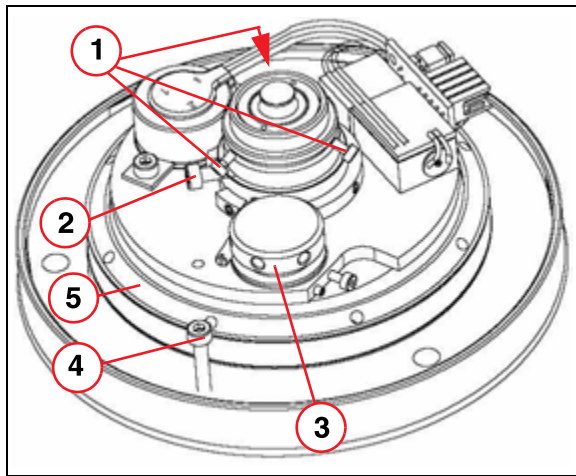


Fig. 27: Adjusting the camera

### Centering the camera

#### NOTE

The camera can be centered by moving the optics. Centering is performed in the factory and should be acceptable. The camera optics must be moved toward the centering bolts.

### Adjustment reproduction scale

**Prerequisites:** Camera centering should be OK.

1. Loosen the clamping screw (4/Fig. 27 / p. 49).
2. Loosen the lock ring (5/Fig. 27 / p. 49).
3. Unplug the connectors (1/Fig. 25 / p. 47), (2/Fig. 25 / p. 47) and disconnect the fan wires (3/Fig. 25 / p. 47).
4. Remove the 3 ISK screws from the camera flange (1/Fig. 27 / p. 49).
5. You can increase/decrease the image size by turning the entire camera. The camera plugs must not be in the same position.
  - ⇒ Turn clockwise = larger image
  - ⇒ Turn counter clockwise = smaller image
6. Rotate the camera until the plugs are at the same location prior to the adjustment and re-tighten the 3 M2 ISK screws (1/Fig. 27 / p. 49).
  - ⇒ Tightening torque **14 ± 1Ncm**
7. Tighten the lock ring (5/Fig. 27 / p. 49).
8. Retighten the clamping screw (4/Fig. 27 / p. 49).
9. Reattach the connectors (1/Fig. 25 / p. 47), (2/Fig. 25 / p. 47) and the fan wires (3/Fig. 25 / p. 47).





10. Release fluoro and check the image size. Repeat the adjustment if necessary.
11. Open the service application and adjust the 0-degree position of the image.  
Path: <Service>-<Main System>-<Adjustment>-<Image Rotation>.
12. Perform the IQ test.

## Camera focus

**Prerequisites:** Camera reproduction scale should be OK.



1. Loosen the focus ring clamping screw (2/Fig. 27 / p. 49).
2. You can adjust the optimum sharpness by turning the focus ring (3/Fig. 27 / p. 49).
3. Release fluoro and check the sharpness. Repeat the adjustment if necessary.
4. Retighten the focus clamping screw (2/Fig. 27 / p. 49).
5. Perform the IQ test.

<b>NOTE</b>
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**Adjusting the camera focus also has a slight effect on the reproduction scale. The reproduction scale adjustment may have to be repeated.**

## Basic unit control panel

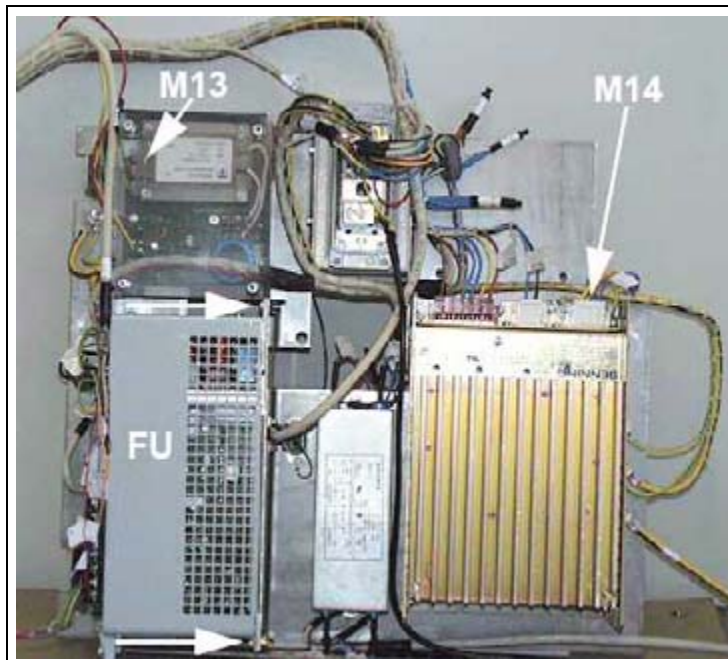


Fig. 28: FU

1. Disconnect the plugs for the control panel from board D1.
2. Remove the cable clip of the cable to the control panel.
3. Remove the Allen screws on the fastening ring (swivel joint of the control panel).
4. Replace the control panel.
5. Reinstall the fastening ring.
6. Reconnect the cable.
7. Reattach the cable clip.
8. Perform a functional test of the control panel.

## Frequency converter FU (vertical lift)

**WARNING**

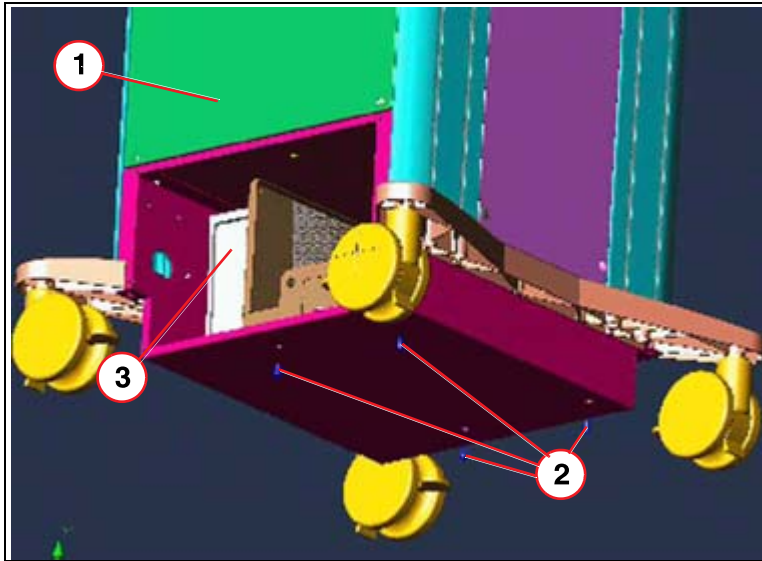
**Electrical voltage!**

**If ignored, death or serious physical injury can occur.**

⇒ **Switch the system power supply off.**

1. Remove the cover over the plug board / terminal board of the frequency converter.
2. Disconnect the power plug.
3. Remove the cable clips and cable ties at and in front of the frequency converter.
4. Disconnect all the cables on the frequency converter.
5. Remove the jumper FU.PTC - FU.UKZ on the new frequency converter. The jumper is not required.
6. Replace the frequency converter after removing the Allen screws ([Fig. 28 / p. 51](#)).
7. Reconnect all cables.
8. Reconnect the power plug.
9. Re-secure the cables with cable ties.
10. Reattach the cables with the cable clips.
11. Perform a functional test of the lifting column movement.

## Replacing the power supply assembly



*Fig. 29: Power supply*

1. Switch off the system.
2. Remove the system power plug.
3. Unscrew the 4 screws from the rear cover and remove the cover ([1/Fig. 29 / p. 53](#))
4. Unscrew the 6 screws from the lower rear cover and remove the cover (cover already removed in ([Fig. 29 / p. 53](#))).
5. Unplug the 2 voltage cables ([3/Fig. 29 / p. 53](#)) from the UPS.
6. Unscrew the 4 Allen screws ([2/Fig. 29 / p. 53](#)) for the power supply component.

7. Pull the power supply component about 10cm out of the trolley.

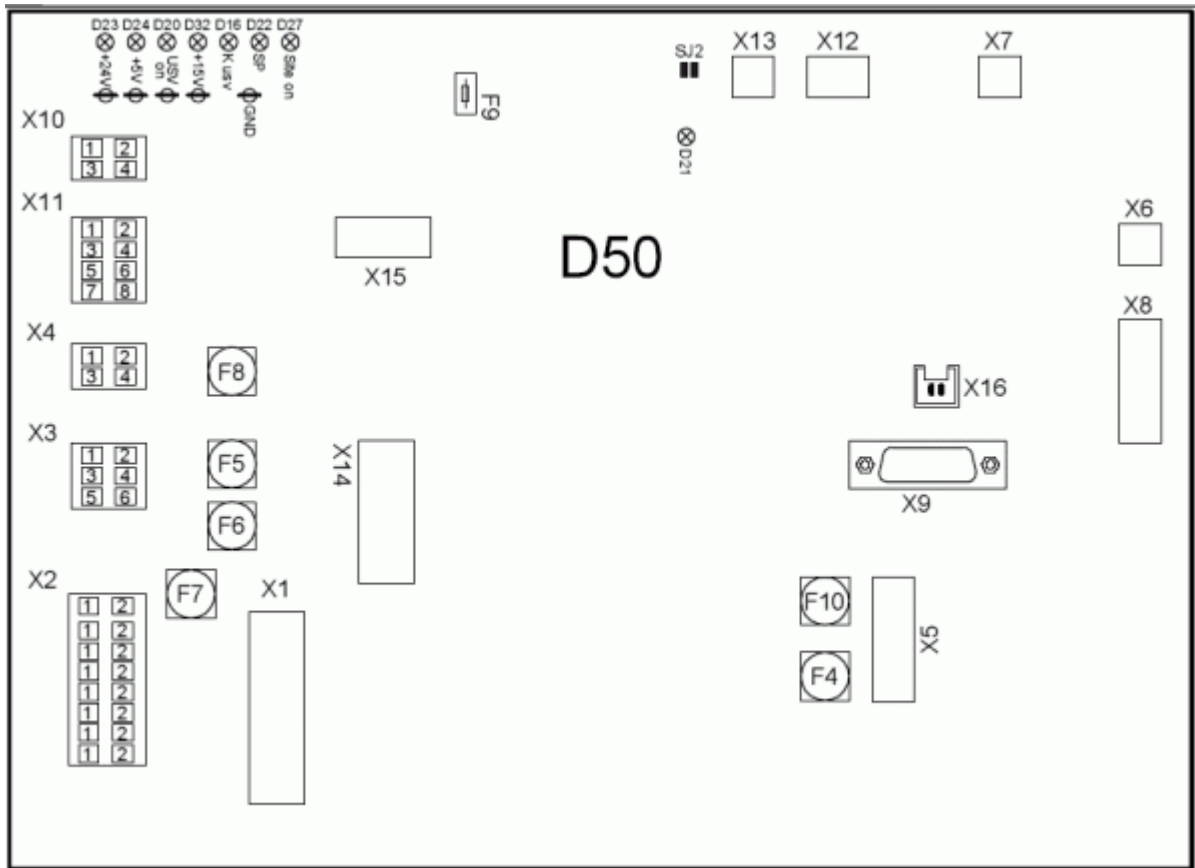


Fig. 30: D 50



8. Disconnect the power line at connector D50 X 11

- ⇒ Live Monitor - X 11.2 blue / X11.5 brown
- ⇒ Imaging System (PC) - X 11.3 blue / X11.6 brown
- ⇒ UPS output - X 11.1 blue / X 11.4 brown

9. Disconnect the power line at connector D50 X 2

- ⇒ Reference Monitor - X 2.1 blue / X 2.2 brown
- ⇒ Paper Printer (option) - X 2.1 blue / X 2.2 brown

10. Disconnect the power line at connector D50 X 4

- ⇒ UPS input - X 4.2 blue / X 4.3 brown

11. Disconnect the display unit cable at connector D50 X 3

- ⇒ X 3.1 = green / x 3.2 = red / X 3.3 = yellow / X 3.4 = black / X 3.5 = violet / X 3.6 = blue

12. Disconnect the ground wires coming from the monitor trolley and the SG-cable .

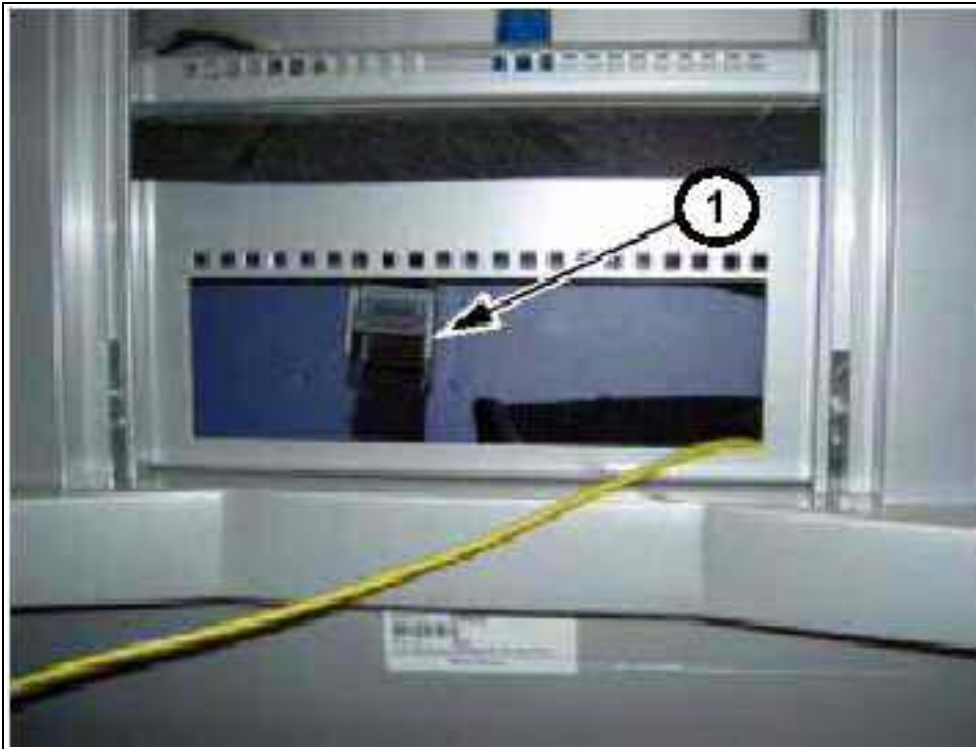
13. Unplug D50 X6, X7, X8, X9, X12 and the X13 connector.

14. Unplug the PC connectors D 66 X4 (BNC) and D66 X5 (Fig. 35 / p. 60) and pull these cables down.

15. Remove the cable clamps from the SG-cable and the power cable.

16. Disconnect and pull the SG-cable and the power cable out from the power supply assembly.
17. Remove the power supply component from the monitor trolley.
18. Install the new power supply component in reverse order.
19. Switch on the system and carry out a functional test.

## Replacing the UPS



*Fig. 31: Replacing the UPS\_2*

1. Remove the rear cover from the monitor trolley.
2. Disconnect the 2 power plugs from the UPS.
3. Loosen the tension band (1/Fig. 31 / p. 56) and remove the UPS from the monitor trolley. Side covering was already removed in (Fig. 31 / p. 56).
4. Install the new UPS component in reverse order.
5. Switch on the system and carry out a functional test.



## Replacing the UPS battery

**Prerequisites:** UPS must be replaced from the monitor trolley.

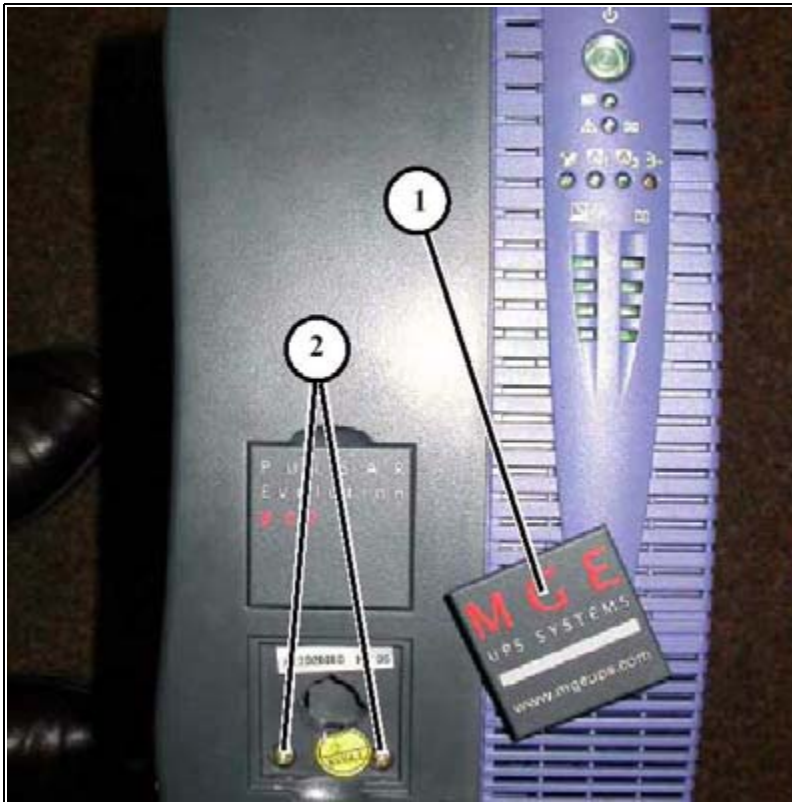


Fig. 32: Replacing the UPS\_battery\_1



Fig. 33: Replacing the UPS\_battery\_2

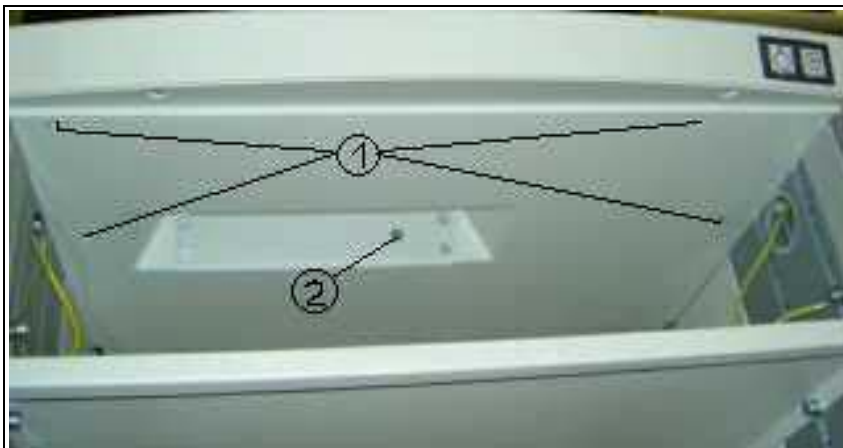
1. Remove the plastic facing (1/Fig. 32 / p. 57) from the UPS
2. Unscrew the 2 slotted grub screws (2/Fig. 32 / p. 57) from the UPS and remove the cover
3. Disconnect the connector (1/Fig. 33 / p. 58) and pull the battery out of the slot.

Insert the new battery and install the UPS covers and the UPS component in reverse order in the monitor trolley.

**NOTE**

**Make sure that the connector contacts are not bent when plugged in! Check the contact (1/Fig. 33 / p. 58) if the system does not switch on.**

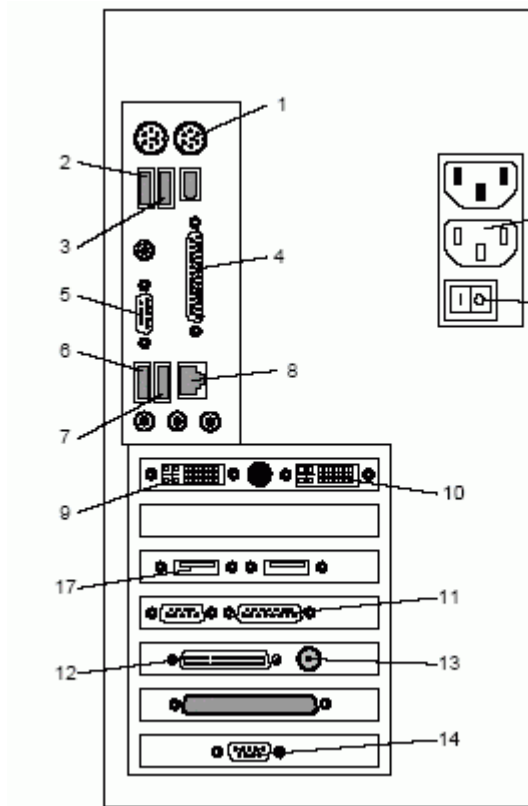
## Replacing the keyboard



*Fig. 34: Replacing the keyboard\_3*

1. Remove the 4 screws ([1/Fig. 34 / p. 59](#)).
2. Lift the keyboard upward and out of the monitor trolley.
3. Unplug the keyboard connectors.
4. Install the new keyboard in reverse order.
5. Carry out a functional test.

## Replacing the PC



### Connection

- 1 UPS control
- 2 Keyboard
- 3 Mouse
- 4 Printer connect parallel
- 5 COM 1
- 6 Dongle
- 7 Printer connect USB
- 8 LAN connector
- 9 Monitor B
- 10 Monitor A
- 11 M50 D20 X9
- 12 D66 X5
- 13 D66 X4 (Gigalink)
- 14 Adapter plug COM1
- 15 Net plug
- 16 On, off switch
- 17 CAN converter (option)

Fig. 35: PC rear

1. Save patient data and create a backup if possible.
2. Switch off the system and remove the system power plug.
3. Unscrew the 6 screws from the rear cover (1/ Fig. 29 / p. 53) and remove the cover.
4. Unplug all cable connections from the PC (Fig. 35 / p. 60).
5. Loosen the tension belt from the PC.
6. Remove the old PC and insert the new PC.
7. Reconnect all PC plugs (Fig. 35 / p. 60).

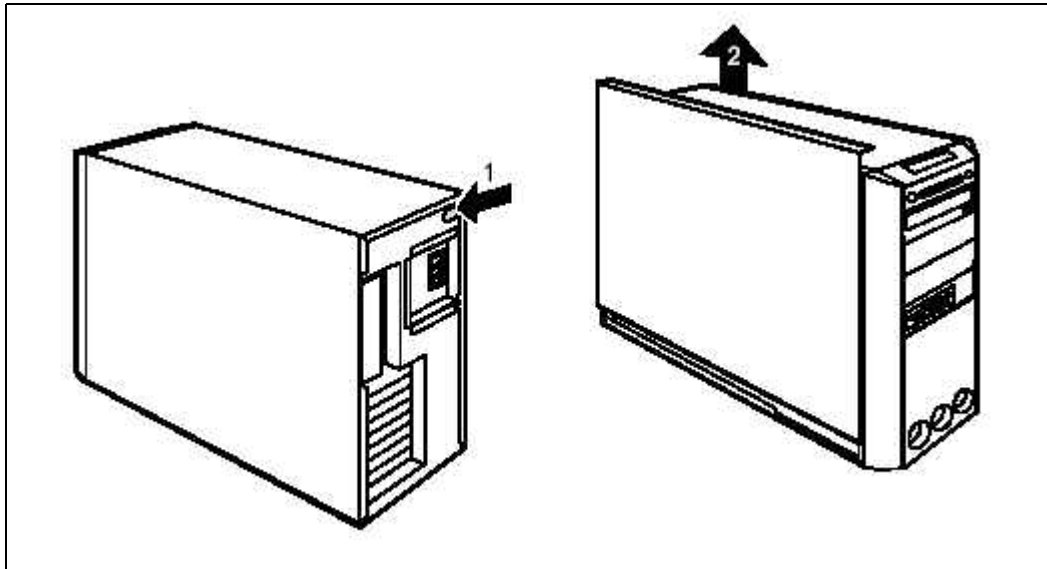
### NOTE

**All plugs must be connected as shown in the figure above for the software installation to be successful (Fig. 35 / p. 60).**

8. Switch on the system and install the software according to the "System Software Installation" instructions.
9. Carry out a functional test.

## Removing the PC covers

### Opening the casing



*Fig. 36: Remove PC covers*

1. Switch off the system.
2. Pull the power plug out of the power outlet.
3. Place the device in a convenient working position.
4. Press the green unlocking button on the rear of the casing (1/Fig. 36 / p. 61).
5. Hold the green unlocking button depressed and slide the casing side cover upwards in the direction of the arrow (2/Fig. 36 / p. 61).
6. Pull the side cover out of the casing.

## Removing the front panel

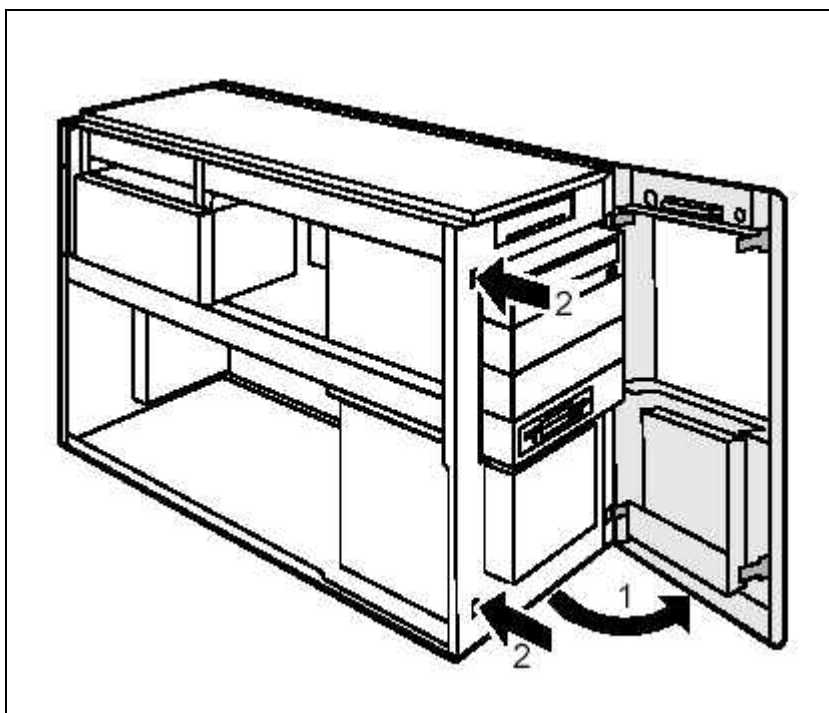
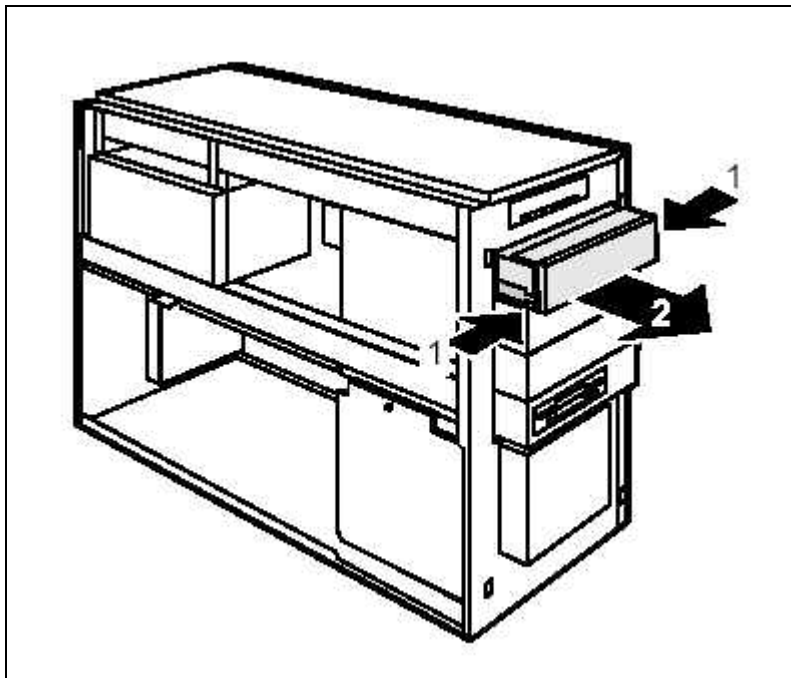


Fig. 37: Removing the front panel

1. Open the casing ([Opening the casing / p. 61](#)).
2. Detach the unlocking lever ([2/ Fig. 37 / p. 62](#)) and open the front panel ([1/ Fig. 37 / p. 62](#)).
3. Detach the plastic hook from the front panel of the casing and carefully remove the front panel. If you pull too hard, you may loosen or damage the LCD cable.
4. The LCD cable is long enough so that you can carefully place it to one side with the front panel. You do not need to unplug the cable before removing the front panel.



## Replacing the DVD drive



*Fig. 38: Replacing the drive*



1. Replace the PC from monitor trolley (see the “Replacing the PC” section).
2. Open the casing (see the “Opening the casing” section).
3. Remove the front (see the “Removing the front panel” section).
4. Disconnect the data and the power supply connectors from the drive.
5. Press the rails (1/Fig. 38 / p. 63) together and pull the DVD drive out of the casing (2/Fig. 38 / p. 63).
6. Push the new DVD drive into the casing until the rails engage.
7. Plug the data and the power supply connectors into the drive. Make sure the polarity is correct.
8. Attach the front panel (see the “Attaching the front panel” section).
9. Close the casing (see the “Closing the casing” section).
10. Reinstall the PC into the monitor trolley in reverse order ([Replacing the PC / p. 60](#)).
11. Carry out a functional test.



## Replacing the lithium battery

**Prerequisites:** The latest BIOS update CD must be available for the system.

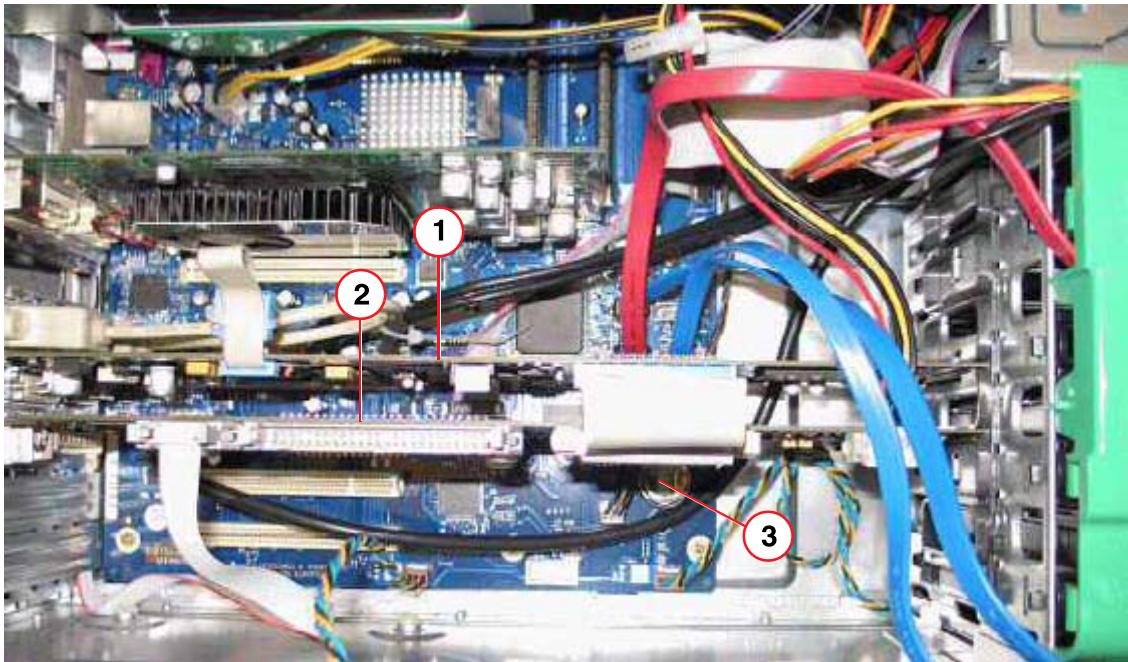


Fig. 39: PC\_components

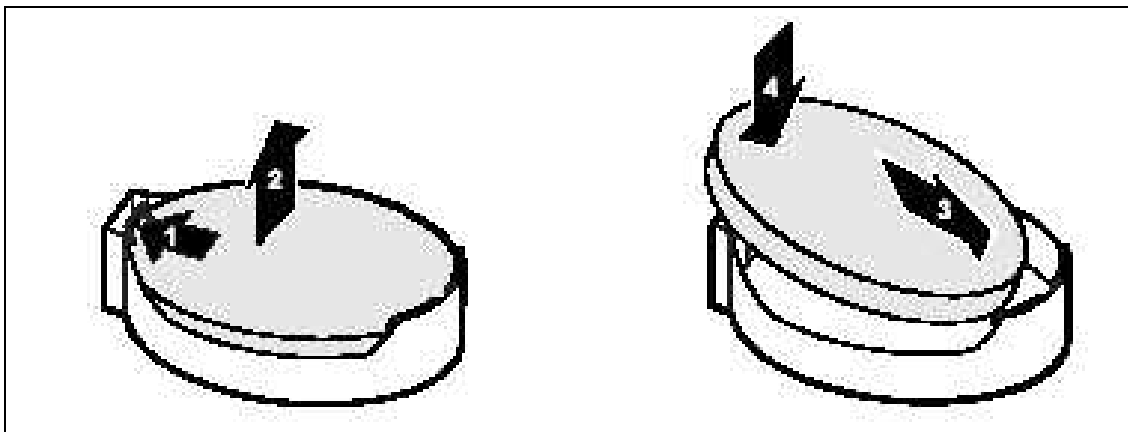


Fig. 40: Replacing the lithium battery



## NOTE

In order to permanently save the system information, a lithium battery is installed to provide the CMOS memory with current. An appropriate error message notifies the user when the charge is too low or the battery is empty. The lithium battery must be replaced.

**Incorrect replacement of the lithium battery may lead to a risk of explosion!**

The lithium battery may be replaced only by an identical battery or a type recommended by the manufacturer.

**Make sure that you insert the battery correctly. The positive (+) pole must be on top!**

**Do not touch the negative (-) pole of the battery with your finger. Use gloves or a cotton cloth to insert the battery.**



1. Open the casing ([Opening the casing / p. 61](#)).
2. Press the locking lug in the direction of the arrow ([1/Fig. 40 / p. 64](#)); the battery gently pops out of the holder ([2/Fig. 40 / p. 64](#)) and remove the battery ([3/Fig. 39 / p. 64](#)).



- ➔ See the "Disposal Instructions" for disposing of the old battery.
3. Push the new lithium battery of the identical type into the holder ([3/Fig. 40 / p. 64](#)) and press it downward until it engages ([4/Fig. 40 / p. 64](#)).
4. Reinstall the casing in reverse order.
5. Reinstall the PC in the monitor trolley in reverse order ([Replacing the PC / p. 60](#)).

## Restoring BIOS settings (necessary after battery replacement)

## NOTE

**When the battery is empty, the BIOS is set to default and the first boot device is the CD-ROM drive.**

**In addition to activating the system on/off switch, the following may be necessary:**

- Turn off the PC via the power switch on the rear panel of the PC.
- Turn on the PC via the rear power switch and press the button on the front panel of the PC.
- If the system is unintentionally switched off during BIOS installation, it may necessary to press the reset key ([2/Fig. 34 / p. 59](#)) with a pin shaped object.

1. Switch on the system.
  - ⇒ The following message appears: Error: Check the date and time setting. Warning: System CMOS checksum bad - default configuration used.
  - ⇒ The system will not boot.
2. Open the CD drive and insert the BIOS CD.
3. Press <Ctrl>-<Alt>-<Delete> to restart the PC.
  - ⇒ The following message appears: BIOS installation done - system ready for software installation. Please remove BIOS CD (CD drive opens)
4. Do not remove the BIOS CD and close the CD drive.
5. Press <Ctrl>-<Alt>-<Delete> to restart the PC again.
  - ⇒ The following message appears: BIOS installation done - HIPAA installed. Please remove BIOS CD.
6. Remove the BIOS CD.
7. Press <Ctrl>-<Alt>-<Delete> to restart the PC.
8. The system boots and the syngo application starts.

### **Date and time settings (necessary after battery replacement)**

1. Enter a new administrator password and click <Save>.
  - ⇒ Path: <Service>-<Configuration>-<Users>
2. Close the service application and log off as “med user”
  - ⇒ Path: Syngo menu bar - <Options>-<End Session...>-<Log Off..>
  - ⇒ Application software shuts down.
3. Enter “administrator” in the pop-up login window under name and your new password under password.
  - ⇒ The system is now on the Windows level.
4. Click the clock icon in the Windows menu bar at the bottom of the screen.
5. Set the current date and time and click <OK>.
6. Press <Ctrl>-<Alt>-<Delete> to restart the PC.
  - ⇒ The system boots and the syngo application starts.
7. Check the date and time and carry out a functional test.

## Replacing a PCI board (long PCI board design)

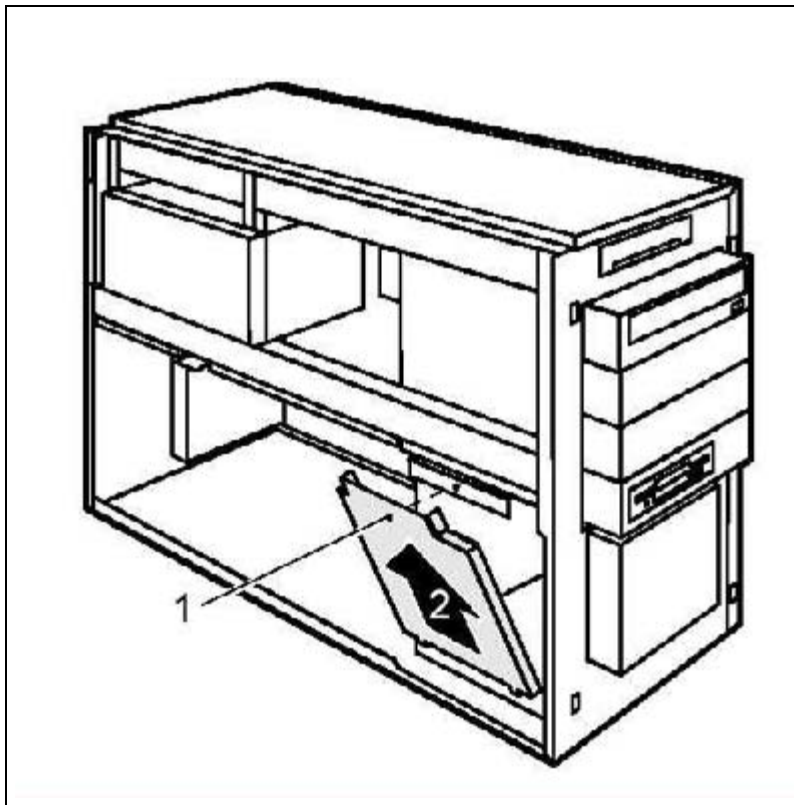


Fig. 41: Replacing a PCI board\_1

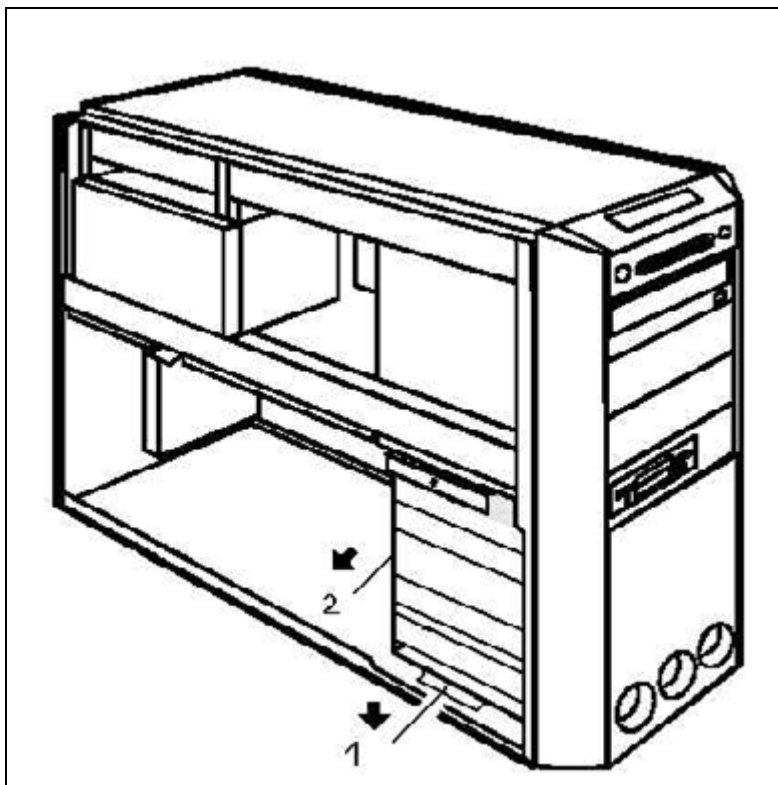


Fig. 42: Replacing a PCI board\_2

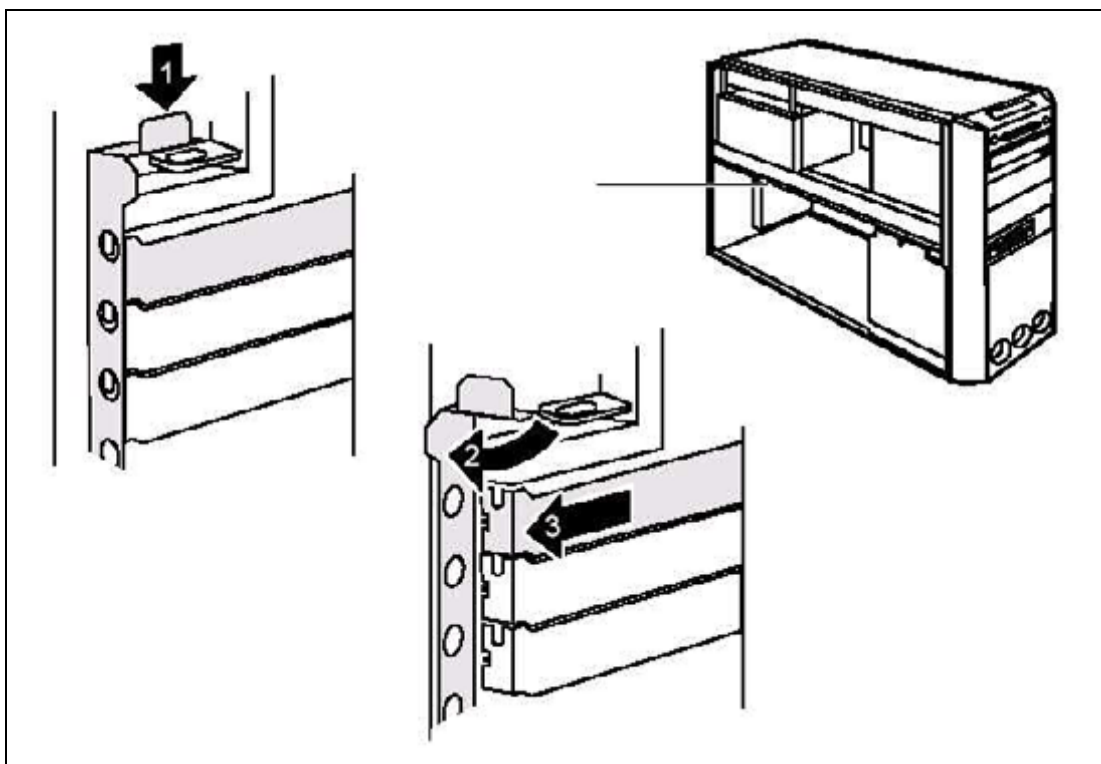


Fig. 43: Replacing a PCI board\_3

**NOTE**

Work steps 1 through 6 are necessary only for the long-design PCI board (e.g., CIPP board )

See ARCADIS spare parts list for which boards are released for field exchange.



1. Open the casing ([Opening the casing / p. 61](#)).
2. Remove the front panel ([Removing the front panel / p. 62](#)).
3. Loosen the screw ([1/ Fig. 41 / p. 67](#)).

4. Fold out the cover (2/Fig. 41 / p. 67).

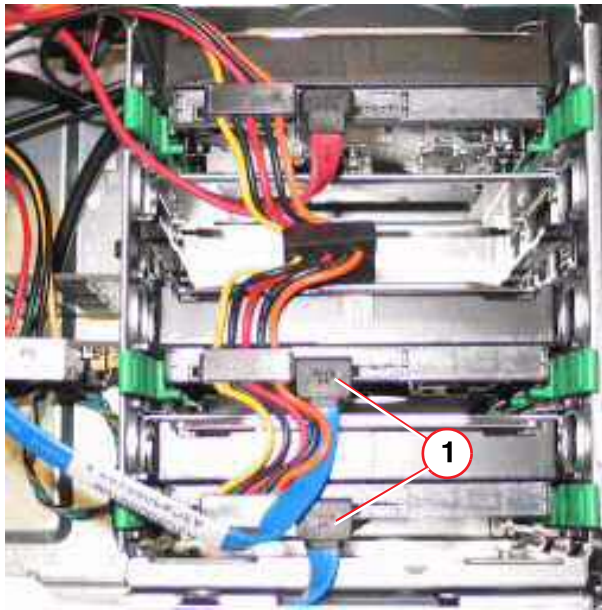


Fig. 44: Drive cable

5. Disconnect the data and power supply cables to the hard disk drive (Fig. 44 / p. 69).

**CAUTION**

**Risk of patient database loss!**

**Hard drive 3 must be connected to SATA-port 2 and hard drive 4 to SATA-port 3 (1/Fig. 44 / p. 69).**

⇒ **Make sure that the drives are correctly adapted (1/Fig. 44 / p. 69) when reconnecting the drives.**

6. Press the locking bar (1/Fig. 42 / p. 67) downward and pull the hard drive casing (2/Fig. 42 / p. 67) out of the PC.
7. Press the unlocking mechanism (1/Fig. 43 / p. 68) down and open the locking rail (2/Fig. 43 / p. 68). The word "PRESS" is embossed on the unlocking mechanism.
8. Remove the locking screws from the relevant slot.
9. Disconnect the connectors from the PCI board.
10. Remove the board from the slot (3/Fig. 43 / p. 68).
11. Take the new board out of its packaging and install it in reverse order.
12. Attach the front panel in reverse order (Fig. 37 / p. 62).
13. Reinstall the casing in reverse order (Fig. 36 / p. 61).
14. Reinstall and connect the PC in the monitor trolley in reverse order (Fig. 35 / p. 60).
15. Carry out a functional test.

## Low voltages

From test point	To test point	Voltage	Adjuster
D1.X37 (0 V)	D1.X30 (+5 V)	+5.1 V to +5.2 V	M14. +5 V/adj.
D1.X39 (0 V)	D1.X32 (+15 V)	+14.9 V to +15.1 V	M14. +15 V/adj.
D1.X39 (0 V)	D1.X33 (- 15 V)	-14.8 V to -15.2 V	M14. -15 V/adj.
D30.X1.8 (0 V)	D30.X1.9 (+24 V)	+24.0 V to +29.5 V	Not adjustable
D30.X21.1 (0 V)	D30.X21.10 (+24 V)	+22.8 V to +29.5 V	Not adjustable
D30.X20.1 (0 V)	D30.X20.3 (+27 V)	+27.3 V to +27.8 V	D30 R115
M13.S- (0 V)	M13.S+ (+13 V)	+13.1 V to +13.3 V	M13.TR1

## Image intensifier voltages

Voltage	Test point	Potentiometer	Test Certificate Reference voltage	Voltage divider ratios
U1	TP1	P1	E1	1:100
U2	TP2	P2	E2	1:1000
U3	TP3	P3	E3	1:10000
UA (30 kV)	TPA	PA	A	1:10000
GND (0V)	TPG	n.a.	n.a.	n.a.

## Monitor trolley voltages

Voltage for	Test point	Voltage	Comment
Generator	X3.1 -- X3.2	200 V ~ to 215 V ~	To main system
Generator	X3.5 -- X3.6	230 V ~ to 246 V ~	To main system
ASPIA PC, live monitor	X11.1 -- x11.4	230 V ~ to 246 V ~	From UPS output
Reference monitor, Paper printer	X2.1 -- X2.2	230 V ~ to 246 V ~	Paper printer = option
UPS input	X4.2 -- X4.3	230 V ~ to 246 V ~	Supply voltage



## Brake forces / brake torques

### Measuring the horizontal movement forces



Fig. 45: C\_bow\_

The attachment point for the spring scale is the end of the railing on the l.l. side and/or the handgrip of the horizontal carriage. Always pull along the direction of movement at a constant speed.

- ⇒ The maximum force for moving the horizontal carriage at a constant rate when the brakes are released is 115 N.
- ⇒ When the brakes are applied, the force must be > 180 N .

Measurement A - B:

Pull on the handgrip of the horizontal unit (2/ Fig. 45 / p. 73).

Test points after 30, 170 and 200 mm.

Measurement B - A:

Pull on the railing on the l.l. side (1/ Fig. 45 / p. 73).

Test points after 30, 170 and 200 mm.

### Measuring the horizontal swivel forces

- ⇒ Torque when the brakes are released max. 55 Nm.
- ⇒ Torque when the brakes are applied > 100 Nm.

C-arm vertical, the attachment point is the end of the railing on the I.I. side (see Fig. 1).  
The distance from the fulcrum / axis to the attachment point is 60 cm. Maximum force to be applied =  $55 \text{ Nm} / 0.6 \text{ m} = 92 \text{ N}$ .

### Measuring the orbital movement forces

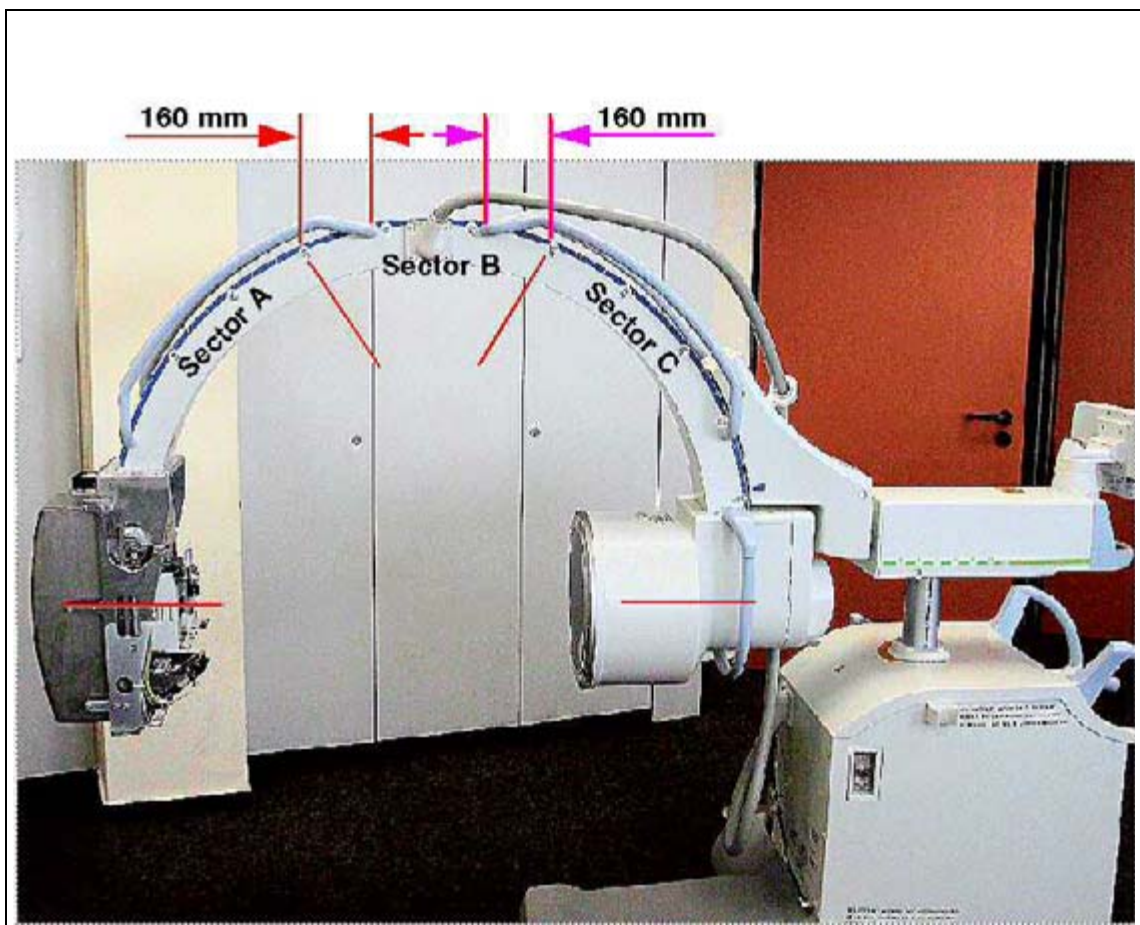


Fig. 46: Torques

The attachment point for the spring scale is the end of the railing on the I.I. side in sector B. Always pull along the C-arm at a constant speed.

## Movement when brakes are released

- ⇒ With the C-arm in vertical position, the force used to move the C-arm at a constant rate must not exceed 85 N.
- ⇒ With the C-arm in horizontal position, the force used to move the C-arm at a constant rate must not exceed 120 N.
- ⇒ When brakes are applied, the force required for movement when the C-arm is in the vertical position is > 85 Nm

### Measurement A-C:

Start at 90° (I.I.), pull with spring scale to -90° (single tank).

The C-arm opening faces downward at the start of the measurement.

### Measurement C-A:

Start at -90° (single tank), pull with spring scale to 90° (I.I.).

The C-arm opening faces downward at the start of the measurement.

## Measuring the angular movement forces

The attachment point for the measurement is the railing next to the I.I., where the C-arm has an orbital position of 0° and an angulation of 0°.

- ⇒ When the brakes are released, the force required for movement is between 10 and 50 N.
- ⇒ When the brakes are applied, the force required for movement must exceed 70 N in order to move the C-arm.

## Angulation Brake Magnet

**CAUTION****Risk of burn!**

⇒ When the angulation brake is released, the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.



Fig. 47: Torques\_3

1. Remove the cover of the horizontal carriage (see [\(Removing the cover of the horizontal carriage / p. 18\)](#)).
2. Remove the rear cover with the handle for the horizontal lift movement after removing the 4 countersunk screws. The angulation brake magnet is now visible.
3. Remove the cover plate over the C-arm cable guide.
4. Remove the 3 attachment screws and remove the brake magnet ([Fig. 47 / p. 76](#)).

**NOTE****Remove both parts of the brake magnet!**

5. Remove the plug connection for the brake magnet and insert the new brake magnet.
6. Place the new brake magnet back on the shaft and attach it with the 3 screws ([Fig. 47 / p. 76](#)).
7. Secure the cable with cable ties.
8. Reattach the cover over the C-arm cable guide.
9. Reinstall the cover. Make sure the ground wire is connected properly.
10. Perform a function test of the brake (see "Brake forces / Brake torques").
11. A 30 mm wrench (hexagonal) is required for adjusting the brake.

## Horizontal swivel brake



**CAUTION**

**Risk of burn!**

⇒ **Releasing the swivel brake causes the brake magnet to heat up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.**

- Swivel brake replacement kit 56 44 955 includes replacement instructions SPR2-230 841.02... Please use these instructions for performing the work steps.

## Vertical lift brake

**⚠ CAUTION****Risk of burn!**

- ⇒ When the vertical lift brake is released (while lifting or lowering the vertical lift column) the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.

**⚠ CAUTION****Risk of injury!**

Noncompliance can lead to slight or moderate injuries and/or property damage.

- ⇒ To replace the vertical lift brake, the ARCADIS Avantic must be placed on its side.
- ⇒ This requires 6 people. To avoid damage to the ARCADIS Avantic or the floor, use a suitable floor covering (e.g., woolen blankets or cartons).



Fig. 48: Motor\_3



*Fig. 49: Motor\_2*

1. Remove the basic unit cover.
2. Place the ARCADIS Avantic on its side.
3. Remove plug D30.X8 and eject the contacts.
4. Remove the 3 mounting screws for the vertical lift brake and replace the brake.
5. Remove plug D30.X8.
6. Eject the contacts from plug D30.X8.
7. Route the wires of the new vertical lift brake to board D30 and insert the contacts into the plug housing.



## Vertical lift motor

**⚠ CAUTION****Risk of burn!**

- ⇒ When the vertical lift brake is released (while lifting or lowering the vertical lift column) the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.

**⚠ CAUTION****Risk of injury!**

Noncompliance can lead to slight or moderate injuries and/or property damage.

- ⇒ To replace the vertical lift motor, the ARCADIS Avantic must be placed on its side.
- ⇒ This requires 6 people. To avoid damage to the ARCADIS Avantic or the floor, use a suitable floor covering (e.g., woolen blankets or cartons).



Fig. 50: Motor\_3

1. Remove the vertical lift magnet from the vertical lift motor (3 screws).
2. Remove the attachment screws for the vertical lift motor.
3. Remove the vertical lift motor with the gears from the spindle.
4. Disconnect the wires from the frequency converter FU.
5. Route the wires of the new vertical lift motor to the frequency converter FU and connect them.



6. Place the new motor on the spindle. Make sure the spindle is seated correctly in the gears.
7. Attach the motor with the screws.
8. Install the vertical lift magnet on the vertical lift motor.
9. Return the ARCADIS Avantic to the upright position.
10. Lubricate the spindle and the lifting column mounting.
11. Check the vertical lift function. Also check that the vertical lift motor switches off at the end positions of the vertical lifting column (limit switches).

## Vertical lift limit switches

1. Replace the limit switches. Reconnect the wires.
2. To adjust the limit switches, move the lift column **slowly and carefully** until it is positioned just in front of the mechanical end stop.
3. Adjust the respective limit switch and tighten the screws.
4. Make sure the limit switch is functioning correctly.
5. To do this, move back out of the end position.
6. Then **slowly and carefully** move into the end position.
7. The lifting column motor must switch off prior to reaching the end position and the lifting column must come to a full stop.
8. Move the lifting column approximately 10 cm away from the end position.
9. Now move the lift column at full speed in the direction of the end position by pressing and holding the lift column button.
10. The lifting column motor must switch off prior to reaching the mechanical end stop, and the lifting column must come to a full stop.

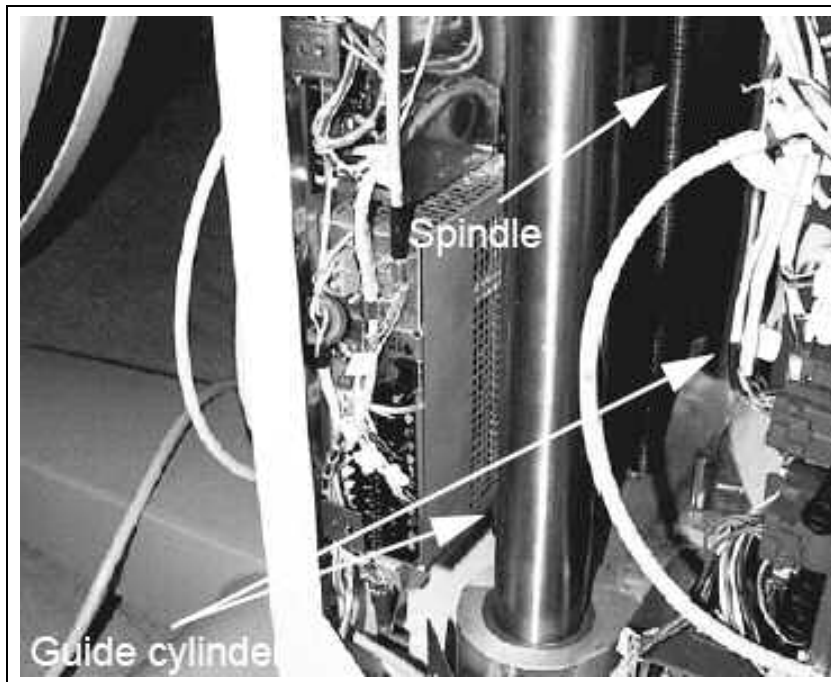
## Lubricating the lifting column parts

- Lubricate the spindle of the lifting column and the mounting of the guide cylinder once a year. If you hear noise during operation, check the lifting column mechanism for damage.

## Spindle

- Lubricate the spindle with approx. 10 - 20 ml of "Optimol, Optipit" special-purpose oil. If you hear noise during operation, check the lifting column mechanism for damage.

## Guide cylinder



*Fig. 51: Spindle*

1. Grease the guide cylinders with approximately 5 - 10 ml of "Slick Pac PTFE" special bearing grease.
2. Then move the lifting column through the entire travel range twice to ensure that the grease is evenly distributed.

**WARNING****X-ray radiation!****If ignored, death or serious physical injury can occur.****⇒ Protect yourself from radiation! Wear a lead apron!****NOTE**

**When measuring the tube current, the voltage divider current must be subtracted from the measured value. The voltage divider current depends upon the kV and is calculated according to Ohm's law. The voltage divider resistance is 400 MOhm.**



- Switch the system off.
- On board D21, set switch S3 to ON.
- Connect the mA measuring instrument to D21.X121 MAS+ and MAS-.
- Switch the system on.
- The total current can be read off during radiation.
- Read the kV value that results while measuring the current.

The tube current can now be calculated:

**Tube current [mA] =**

**= total current [mA] – (High voltage [kV] : Volt. divider resistance [MOhm])**

e.g.:

A total current of 5.275 mA is measured at 110 kV.

- After the measurement, set switch S3 on D21 back to OFF.

**WARNING****X-ray radiation!****If ignored, death or serious physical injury can occur.****⇒ Protect yourself from radiation! Wear a lead apron!****NOTE**

**When measuring the tube current, the voltage divider current must be subtracted from the measured value. The voltage divider current depends upon the kV and is calculated according to Ohm's law. The voltage divider resistance is 400 MOhm.**



- Switch the system off.
- On board D21, set switch S3 to ON.
- Connect the mA measuring instrument to D21.X121 MAS+ and MAS-.
- Switch the system on.

- The total current can be read off during radiation.
- Read the kV value that results while measuring the current.

The tube current can now be calculated:

$$\text{Tube current [mA]} = \text{total current [mA]} - \frac{\text{High voltage [kV]}}{\text{Volt. divider resistance [M}\Omega\text{]}}$$

$$\text{Tube current [mA]} = 5.275 \text{ [mA]} - \frac{110 \text{ [kV]}}{400 \text{ [M}\Omega\text{]}} = 5.275 \text{ [mA]} - 0.275 \text{ [mA]} = 5.0 \text{ mA}$$

e.g.:

A total current of 5.275 mA is measured at 110 kV.

- After the measurement, set switch S3 on D21 back to OFF.

**Revision 02**

- Chapter 07:
  - Link changed